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FACILITIES AND ENVIRONMENTAL EFFECTS
SURFACE PREPARATION AND COATINGS
DESIGN/PRODUCTION INTEGRATION
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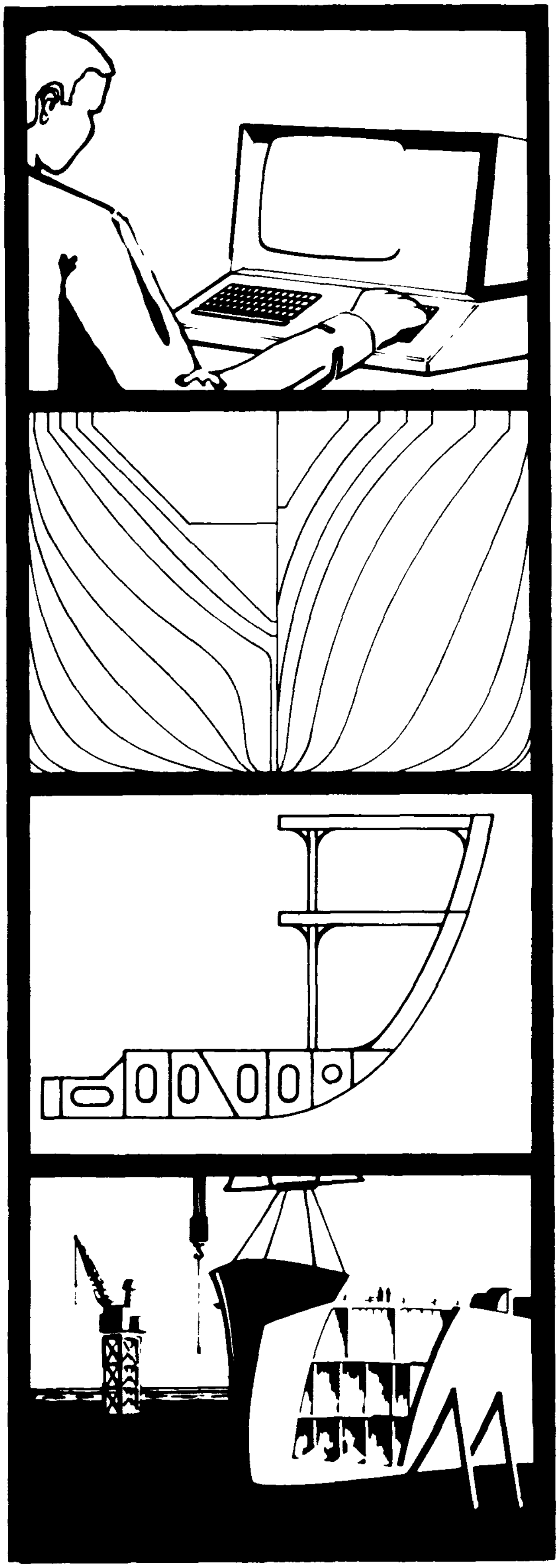

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IN
S HIPBUILDING

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SHIP PRODUCTION COMMITTEE PANEL OVERVIEWS

SP-1 - SHIPYARD FACILITIES AND ENVIRONMENTAL EFFECTS

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Mr. Price has a degree in industrial engineering from Tacoma Tech, and holds an associate degree in civil engineering from the University of Wisconsin. He has also attended Tulane University, Louisiana University, and the University of Alabama.

Prior to his present position, Mr. Price served as senior industrial engineer, ground support equipment for the Boeing Company Aerospace Division.

Mr. Pride is registered in the Smithsonian Institution and Library of Congress for outstanding achievements in the Apollo space program.

Facilities

The Ship Production Committee of the Society of Naval Architects and Marine Engineers re-activated Panel SP-1 Facilities July 20, 1978.

Avondale Shipyards, Inc. accepted the chairmanship and agreed to be the primary sponsor. Presently we have 21 active members from 17 shipyards plus MarAd representation.

During the July, 1978, meeting of Panel SP-1 (Facilities) it was suggested that the panel develop a consensus specification for long range facility plans. The purpose of the consensus specificatian is to provide a standard format and criteria for the development of facility plans. This would be a tool for use by MarAd and a specific shipyard in conjunction with the proposed facility modernization planning program.

During the development of the consensus specification, we experienced sematical problems. Avondale Shipyards, Inc. requested Mr. Richard Muther, President of Richard Muther and Associates, Inc., to speak at our November meeting. Mr. Muther is an expert in the field of Long Range Planning of Industrial Facilities.

On November 9, 1978, Mr. Richard Muther addressed the panel. His primary objective was definition which would do away with the sematical problems.

Mr. Richard Muther's presentation was successful and achieved the ojectives. At the conclusion of the one-day presentation, it was suggested that the panel request MarAd to fund a five-day Long Range Planning of Industrial Facilities Working Conference.

Mr. Garvey of MarAd accepted the proposal and funded the conference. The five-day working conference was held January 29, 1979, through February 2, 1979, in Atlanta, Georgia. Twenty-two (22) representatives from twelve (12) major shipyards attended the five-day conference and currently have a common approach for the development of long range plans.

The second phase of this effort was to prepare proposals, on a voluntary basis, for one or more shipyards to develop a long range plan for their respective yard, utilizing the trained personnel and the consensus specification as a guide.

The detailed proposals were submitted directly to the Assistant Administrator for Commercial Development.

Panel SP-1 (Facilities) currently has a three phase objective emphasing improved productivity.

Phase I - Enhance the Shipbuilding Industries Long Range Facilities Planning Efforts

Phase II - Determine a Feasible Method of Instituting a Cooperative High Risk Facilities Program

Phase III - Determine a Feasible Method of Instituting a Cooperative Facilities Modernization Program

Our efforts are directed toward achieving this three-phase objective, placing emphasis on cost effective producibility. The fiveday Long Range Planning of Industrial Facilities 'work Conference and the Development of the Shipbuilding Consensus Specification for Long Range Facility Plans are basic steps toward enhancing the shipbuilding industry's planning efforts.

'The support of the shipbuilding industry's senior management to consider developing such plans in cooperation with the Maritime Administration is essential for better understanding of the long range economic impact of promoting more productive shipbuilding facilities.

Five shipyards have developed proposals for the development of Long Range Facilities Plans have submitted their proposals to MarAd for funding.

Four yards are presently proceeding to develop their Long Range Plans. Avondale's original proposal, which was submitted on Way **23,** 1979, was rescoped and resubmitted on June 27, 1979. The reason for resubmittal was based on the rough appraisal of Avondale Shipyards, Inc.'s operations after studying the MEL Technology Survey; the Levingston/IHI Technology Transfer; Todd Shipyards' Outfit Planning Document and the Shipbuilding Industry's Consesus Specification for a Long Range Facility Plan. Our study has indicated that, in order to develop a Long Range Facilities Plan, we have to take advantage of all the technological data, which has been developed under the MarAd Research Program, because this would have a direct effect upon the Long Range Facilities Plan.

On December 28, 1979, we submitted an additional proposal to MarAd for implementation of Accuracy Control, Production Planning, Computer Application and Design Engineering for Zone Outfitting with Procurement Specifications.

Recently, we have made schedule adjustments predicated on implemantation and application of these four (4) key management mechanisms. The APL-contract will be used as a basis for measurement of improvement in our productivity and cost effectiveness. We anticipate an approximate three-month flow-time reduction from laying the keel to delivery date.

We understand from Mr. Garvey that this project will be funded by cooperative agreement rather than the standard process. We are looking forward to this method of funding which we believe will enhance the program.

Mr. Starkenburg of Avondale was invited to make the Implementation of IHI Technology presentation which is scheduled at 10:30 am on Thursday, October 16.

PROJECT STATUS

LONG RANGE FACILITIES PLANS

Shipyard'	Mo/Yr. Completion	Percent Complete
Peterson Builders, Inc.	April, 1981	25%
NASSCO	April, 1981	50%
Todd, LA	April, 1981	25%
Avondale Shipyards, Inc.	April, 1981	75%
Ingalls Shipbuilding	Not Committed	

Pipe Shop

Approximately five years ago Avondale started a feasibility study of a semi-automatic pipe handling system and fabrication facility due to the high cost of ship piping systems. This project, it turns out, will be a major management improvement as well as a cost improvement package.

In developing this study we determined that a major change must be made in our method of designing piping as well as in our shop management program.

During the development of the shop management program, which is required to fully implement the Pipe Shop project, our Data Processing Department investigated various programs that could be utilized without major development cost. The COPICS program appeared to solve this problem satisfactorily, but in addition, it can provide scheduling systems which can include: business planning, production planning, etc. Mr. Arnold of Avondale has been requested to speak in detail on this subject at 8:30 am on October 16.

The study revealed that through automation a percentage of the required manhours can be reduced in the following functions: handling, 68%; fitting, 55%; welding, 35%; cleaning, 79%; and coating, 86%. These percentages are based on LASH vessel construction since all basic data is applicable to this series of ships. An overall percentage reduction in fabrication manhours equates to approximately 39.8% per shipset. (Note 30,000 manhours/146,00 dwt tanker.)

We expect to operate the Pipe Shop with the software during the fourth quarter of 1980. We will offer a facility demonstration to the Ship Production Committee during the first quarter of 1981.

Major Productivity Studies In Progress Currently

MarAd has authorized Avondale to conduct a study concerning the economics of the installation of beam lines in shipyards. The beam line, for your information, would be capable of deflanging structurals, cutting all shapes, angles, beams and channels.

The facility would be capable of processing 35,000 stock pieces per year on a two-shift basis for structurals and it would include marking with an accuracy of 1/25 of an inch per piece in one hundred feet.

Preliminary return on investment of this facility is extremely high; it appears that an 80% reduction in manhours can be obtained with this system. Test cases that have been run on small units indicate that these results can be obtained.

Another MarAd project we are studying is a semi-automatic method to assist in the prefabrication, fabrication and assembly of webs, beams, floors, etc. The system provides a method which will reduce the labor, material handling, welding and space required for storage as well as manufacturing. The work within each functional area will he performed by use of adjustable jigging, welding gantries and other mechanical methods. Substantial emphasis will be directed toward automatic welding. Preliminary tests indicate a 43% reduction in manhours with this system.

Environmental

During 1979; we recommended that Panels SP-1 and SP-3 (Shipyard Environmental Effects) be combined into one panel. The logic being that the functional responsibility generally falls under the facilities department. We thought the combined panel would consolidate our industry's efforts regarding industry consensus Input during the comment period of proposed federal regulation.

We coordinate our efforts with the Shipbuilders Council of America Environmental Committee when dealing with governmental agencies such as the Environmental Protection Agency, the Department of Labor (OSHA), the U. S. Coast Guard, and the Department of the Navy. The shipyards, on an individual basis, have to address their respective state and local regulatory agencies to meet the intent of their regulations.

During the proposal period, part of our commitment is to ensure that the regulations are feasible regarding compliance as well as cost effectiveness. We have submitted comments to regulatory bodies as well as conducted independent studies to establish guidelines for use in the development of cost effective regulations.

We have focused on such issues as: (1) Draft Development Document for the Shipbuilding and Repair Industry Drydock Points Source Category; (2) methods of receiving sewage from vessels using drydock facilities; (3) programs for complying with National Pollutant Discharge Elimination Standard Permit requirements; (4) methods of handling hazardous waste; (5) PCB spill prevention plans; (6) civil penalties for violation of Federal Water Pollution Control Act (FWPCA); (7) certificates for financial responsibility; and (8) the OSHA Blasting Standard Development Document.

Typical equipment installed by some shipyards to control the various forms of pollution include oil containment booms, oily waste collection equipment, closed-cycle blasting equipment, water blasting equipment, special air filters, and more efficient combustion control equipment.

During the recent past the shipbuilding and repair industry through Panel SP-1 (SNAME) and the Environmental Committe of SCA have focused our attention on hydrocarbon emissions.

Several approaches have been considered: changing the solvent, inhibiting the photochemicalrectivity (Rule 66 Calif.), developing high solid coatings, developing water base coatings, utilizing carbon absorption and/or inceneration.

Carbon absorption or inceneration can provide 90% emission control, however, the cost impact is prohibitive. In most cases, this type of emission control could cost as much as the paint building.

For example, Peterson Builders is presently erecting a blast and paint building. This facility will cost approximately $650,000. If Peterson Builders has to provide 90% hydrocarbon emission control, this facility would cost in excess of $1,650,000. Presently Peterson Builders is working with their local regulatory agency to determine a cost effective approach. Our panel has responded to their request regarding "state of the art" controls within our industry.

During the past 3 to 5 years most **mil.** spec. and commercial paints comply with Rule 66. It must be noted that the shipbuilding and repair industry uses the paint specified by the owners in most cases.

Panel 023 of SNAME Ship Production Committee has accomplished substantial gains in the use of high solid low solvent coating. This industry effort is over and above Rule 66 compliance. Research and development of effective water base coatings for ships is being conducted.

To the best of our knowledge, the shipbuilding and repair industry has not installed carbon absorption or inceneration facilities on paint buildings. The economic impact is such that these are impractical to date.

The shipbuilding and repair industry is unique in that all painting cannot be carried out "under roof."

Practical regulations, to minimize the insult to environment, should consider the constraints of the industry to which they apply.

Fifteen minutes does not allow very much time to elaborate on our efforts, however I want to take this opportunity to thank the senior management of each of the shipyards represented on our panel. It is essential that the shipbuilding and repair industry work together when addressing regulations, particularly during the comment period, to assure that the economic impact of the regulation will not jeopardize our industry's ability to be competitive in the world market. One of the most significant items achieved by a committee of this type is the rapport developed **between** our counterparts regarding exchange **of** information on day-to-day problem solving.

SP-2 - OUTFITTING AND PRODUCTION AIDS

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Mr. Chirillo is currently responsible for the management of outfitting and production aids projects for the national shipbuilding research program.

He holds degrees from Massachusetts Institute of Technology, University of Louisville, and the U.S. Merchant Marine Academy. Mr. Chirillo's past experience includes project engineer of construction on USNS Hayes, and new construction, ship repair and operation with the U.S. Navy.

ABSTRACT

The presentation given by L. D. Chirillo, Chairman SNAME Panel SP-2, was a preview of the book "Product Work Breakdown Structure - November 1980". It describes how the logic of Group Technology is effectively applied by Ishikawajima-Harima Heavy Industries Co., Ltd. (IHI), to ship construction. As the book will soon be distributed to U.S. shipbuilders, it is not incorporated herein.

However, the following interim report is related, and current, research is pertinent because it addresses IHI's effective application of Group Technology to "Fabrication Ship Planning".

Subj: Interim report for NSRP "Fabrication Shop Planning", SAI Project #l-103-02-833, Todd Seattle, P. O. PS-28444

Phase I of the subject project is complete. This phase consisted of two basic steps. First, a literature search and second, a review of current U.S. shipyard practices.

The literature search yielded a list of documents relating to applications of Group Technology (GT) and/or derivative methods, such as family manufacturing, which might serve as background to this project. Enclosure I is a listing of publications available and is annotated to indicate those titles actually reviewed. Two of the articles listed are in Japanese. An attempt will be made to have these translated as they appear to deal with a review of GT applications in Europe, the U.S. and Japan.

It is important to recognize that Group Technology is a management philosophy as opposed to a manufacturing technique or strategy. GT encompasses activities beyond manufacturing and include processes, organization and informational aspects of a company.

At the heart, of Group Technology is the goal of organizing and assigning work so that common solutions can be applied to common problems throughout the design, planning, material procurement, fabrication and assembly processes. The natural result is more effective mechanization in fabrication, a design-planning-procurement process which inherently promotes productivity and fabrication-final assembly process in which schedules and workloads in system fabrication match assembly needs.

Group Technology concepts have been developed throughout the world. Around 1940, Dr. S. P. Mitrofanow in the U.S.S.R., had advocated a basic idea for grouping machined parts by similarities in production operations. In 1963 Dr. H. Opitz, in Technishe Hochschule Aachen, in Germany, developed a parts classification scheme linking design and manufacturing which he called Group Technology.

This concept, which was useful for small and medium quantity manufacturing, received increasing interest in the machining industry throughout the world. In the U.S., the General Electric Company further developed what they termed "Family Manufacturing."

Dr. Opitz' approach was mainly parts shape-oriented classifications. A manufacturing-oriented parts classification scheme was developed by Dr. K. Tuffentsammer of Stuttgart University. The latter's work, circa 1973, referred to similarities in manufacturing process in terms of turning, milling, grinding and drilling.

In shipbuilding, the Japanese, beginning about 1950, gradually modified their approach from a system-oriented to a product-oriented classification scheme which encompasses basic design through construction processes. This product-oriented approach is similar to that developed by Dr. Tuffentsammer, in terms of logic for grouping by manufacturing process. Whereas most applications of the concepts in the U.S. and other countries have been oriented to specific applications within the manufacturing sector.

The application of techniques to group activities by similarities of processes in shipbuilding has led to higher efficiency, shorter production periods and promoted safer working conditions.

Fabrication activities involve the manufacture of components to be assembled. For example, pipe pieces , vent duct, structural panels, valves, etc. Currently, many components which require similar processes for their manufacture are, in fact, produced in dissimilar ways. For example, fabrication of a pipe piece is planned machine-by-machine or operation-by-operation. With Group Technology, families of parts requiring similar processes for their manufacture can be readily identified. These parts can be grouped in such a manner that a minimum amount of variety is experienced during their fabrication.

Thus, operations on groups of equipment can be planned as a single entity. The result is pre-planned flow lines organized by similar types of fabrication procedures. This is called process categorization. For pipe fabrication it is given the acronym PPFM for Pipe Piece Family Manufacturing. It is a methodology for identification of pipe to be fabrication in terms of diameter, material, geometrical shape, treatment, and so on. PPFM numbers are established by designers and are incorporated on each material list of each pipe piece and identified by work package. PPFM numbers are then grouped by process, fabrication by common flow paths and sorted into physical containers by work package.

These techniques have been demonstrated to provide significant improvements such as simplification of shop control procedures, reduced volume of data, introduction of semi-mass production, increased throughput by reduction in set-up time, reduced scrap, improved machine utilization and reduced work-in-process.

One of the largest potentials .for Group Technology today is in the numerical control field of manufacturing. Similar parts require similar control instructions. Therefore, the programming effort can be significantly reduced.

These methods of grouping do not require the relocation or acquisition of equipment. Flow lines are conceptual and are a means for achieving improved productivity by modifying the procedural approach to the planning for both fabrication and assembly processes. However, analysis of fabricated components by similarities in processing may, in fact, lead to rearrangement of facilities for optimum results and may form the basis for justification of relatively expensive automated equipment.

Many people experienced in manufacturing are familiar with some aspects of Group Technology. They typically view GT as a methodology for coding and classification only, and thus proceed immediately to a review of numbering schemes. It is extremely important, therefore, to recognize that coding and classification systems are merely tools for identifying and grouping parts into families.

Applying GT to fabrication processes in shipbuilding requires an understanding of the logic and principles. For example, one technique, called a manufacturing cell, logically combines all equipment and specialists together in one location to produce a family of components. This may not be practical, however, due to the cost of equipment vs. required volume. A single pipe bender may be able to produce sufficient pipe bends for an entire shipyard's requirements. GT therefore requires tailoring, and each shipyard will necessarily have to develop an individual approach based on their circumstances.

Group Technology applied to fabrication of pipe pieces, such as IHI's PPFM approach, is extremely useful for analyzing required volume and capacity prior to commitment to production. The goal in planning fabrication routing is to enhance productivity by utilizing production line principles. In actual practice, the various steps of fabrication are broken down into steps of cutting, bending, assembling, welding and finishing. Individual steps, thus simplified and specialized, are allocated to prescribed work stations for their execution. At the same time, families of pipe pieces are analyzed to determine the processes to be applied for their fabrication. Schedules are developed for execution of the different processes and are coordinated so as to match the process scheduling to shop operation. Thus, reversals in the direction of work flow are minimized.

Such analyses of fabrication processes and routing of work through a shop is possible only when such factors as fabrication period, man-hours required and fabrication procedure are standardized. For planning actual fabrication in a shop, the families are regrouped so as to take into account similarities not only in shape and normal fabrication procedure, but also other factors relevant to work progress control such as division of work with subcontractors.

Thus, components for actual fabrication are grouped for determining their routing through a shop and are utilized for production control. The families of components identified in design are used principally for other general scheduling requirements. However, identification of components by family permits rapid grouping of components by required process since each family has a pre-defined step-by-step procedure. Actual production work at each stage can be controlled as a group or lot which facilitates control.

Current practice within the U.S. is to work piece-by-piece and operation-by-operation. For example, an individual pipe piece is identified to a systems arrangement drawing. Each individual piece must therefore be planned for installation separately rather than as a group of pipe pieces installed at a particular stage. Control of the assembly (installation) operation by system complicates planning for fabrication by requiring schedules for each piece. Although some yards are beginning to plan assembly work by groups of activities by system (or by pallet), none are utilizing Group Technology techniques to facilitate fabrication. None have implemented flow line concepts for assembly which would also facilitate leveling fabrication shop work loads. One yard has begun to examine flow lines for assembly processes and their efforts will be greatly facilitated by publication and use of the PWBS report.

Another aspect to be considered for fabrication planning is undefined "hot" or "emergency" work. This typically involves repair or overhauls done in the same facility as new construction. In one yard, this undefined work load amounts to 40-50% of the total number of pipe pieces produced. Further complicatinq the situation, all but one of the yards surveyed have separate planning and material control systems but the "undefined" work. This significantly increases the burden on shop managers and results in increased indirect costs to the shipyard. There is a potential for significantly reducing the "undefined" work in overhauls which can directly affect productivity on new construction work that shares the same resources. It is recommended that this aspect be investigated further by examining the potential of utilizing Group Technology approaches to planning for overhauls.

Each of the yards visited expressed an interest in participating in a review of the draft report for this project.

Phase II of the project has been partially completed by receipt of a draft report from IHI describing their approach to fabrication planning. A trip to IHI's Aioi and Kure facilities is planned for early November for review of this report with cognizant managers.

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* Articles Reviewed
** Requires Translation

O-23-1 - **SURFACE PREPARATION AND COATINGS**

John Peart
Chief Chemist - MARAD Program Manager
Avondale Shipyards Inc
New Orleans, Louisiana

NATIONAL SHIPBUILDING AND RESEARCH PROGRAM

Published Reports

(1) Handbook Small Tools for Blasters and Painters

This report defines the principles required for efficient blasting and painting. Specialized cleaning methods from power tool cleaning to closed cycle blasting are discussed, equipment and facilities are described and cost reduction procedures are defined.

(2) Practical Shipbuilding Standards for Surface Preparation and Coatings

This effort developed: (1) a proposed "Shipbuilding Standard for Surface Preparation and Coating" and (2) a Standard Paint and Coating Product Data sheet" and identified the need for a preconstruction conference between the shipyard production and technical sections, the owner representatives and the coating supplier.

(3) Marine Coating Performance for Different Ship Areas

A computer program was developed to compare the effectiveness of the different generic coatings in the different ship areas. The trends indicated by the program was supported by prefailure analysis test results.

(4) Cleaning of Steel Assemblies and Shipboard Touch-up Using Citric Acid

This program confirmed the compatibility of citric acid cleaned surfaces with the present state-of-the-art marine coatings; optimized the cleaning solution and procedure and confirmed the feasibility of a **Phase II** study.

(5) Shipyard Marking Methods

This program identified a marking material meeting the necessary requirements of a durability and overcoatability with marine top coats,

(6) Training Course for Blasters and Painters and Student Handbook

Thirty-six (36) shipyards have participated in the instructor training Program.

Reports Being Edited and Prepared for Publication

(1) Surface Preparation and Coating of Tanks in Closed Areas

(2) Survey of Existing and Promising New Methods of Surface Preparation

Programs Completed - Beports Being Prepared

(1) Evaluation of Water Borne Coatings

(2) Develop a Standard Procedure for Determining Volume Solids of Coatings

Program in Progress

(1) Evaluation of Solventless Coatings

(2) Rust Compatible Primers

(3) Cathodic/Partial Coatings vs Complete Coating in Tanks

(4) Comparison of Surface Profile Measuring Methods

(5) Calcite Deposition in Tanks

FY'79

(1) "Ship Design Considerations for Coating Applications and Maintenance"

(2) "Reclmation of Mineral Abrasives"

(3) "Abrasive Survey" (Proposals received)

FY'80 'Proposed'

(1) "Marine Coating Performance for Different Ship Areas" - Phase II

(2) "Edge Preparation Standard"

(3) "Zone Preparation Guidelines for Preplanning Painting"

A PROGRESS REPORT ON THE REAPS PROGRAM

Douglas J. Martin
Group Leader, Shipbuilding Technology
IIT Research Institute
Chicago, Illinois

Mr. Martin is currently responsible for all REAPS program activities at IIT Research Institute (IITRI) and for computer aided design developments within IITRI.

He holds a degree in naval architecture and marine engineering from the University of Michigan. Mr. Martin has 8 years experience in the design and development of computer aided design systems primarily for ship design applications.

ABSTRACT

The REAPS Program is a shipbuilding industry/Maritime Administration cooperative program aimed at developing and implementing largely computer-based technology into U.S. shipyards in support of design and production functions. The organization, activities and current and planned development projects of the program are reviewed.

REAPS PROGRAM STATUS

I. INTRODUCTION

1. REAPS is a 6-year-old program in which shipyard participants and MarAd cooperate in identifying and implementing computer aids and manufacturing technology to enhance U.S. shipbuilding productivity.
2. Origins in numerical control systems.
3. IITRI serves as Technical Manager.
4. 1980 REAPS Participants
    - Bath Iron Works
    - Bethlehem Steel
    - General Dynamics
    - McDermott
    - National Steel and Shipbuilding
    - Newport News Shipbuilding
    - Peterson Builders
    - Sun Ship Inc

II. ORGANIZATION/OPERATION

1. Executive Committee
    - Policy and Planning
    - R&D Recommendation
    - Review Program Progress
    - Review Technical Manager Performance
    - Establish Project Advisory Groups
2. Technical Representatives
    - R&D Project Formulation/Recommendations
    - Review Project Progress
    - Recommend Advisory Group Formation
3. Project Advisory Groups
    - Review Detailed Project Technical Specifications
    - Define Industry Requirements
    - Recommend Modifications to Project

III. ONGOING R&D PROJECT STATUS

1. Rapid Piping Design and Detailing System
    - Prototype software delivered to REAPS by Newport News (NNS) in February 1980.
    - Software currently being installed by IITRI on its PDP 11/45 computer to provide industry demonstration site and allow for end user technical support
2. Interactive Parts Definition System
    - Current development underway at NNS of interactive graphics system to support part geometry definition, part nesting and shop drawing generation.
    - See NNS paper elsewhere in these proceedings

3. Computer Aided Estimating System for Shipbuilding (CAESS)

- CAESS being developed by National Steel and Shipbuilding (NASSCO) to assist estimators in generation and managing the large volume of information used in preparing detailed estimates. Prototype software will be specifically applicable to steam propulsion but system organization/methodology is applicable to all ship "modules".
- CAESS System (Figure 1) consists of three subsystems; Material List Generation, Material Sizing, and Costing and Pricing.
- Material List Generation Subsystem (Figure 2) is used to build and update material lists for systems which may be defined from: Direct User Input, Historical Data, and An Existing List to be Modified.
- Material Sizing Subsystem (Figure 3) for the prototype software is a pipe sizing program. Operation is to Extract unsized system model information from Material Sizing Models File; Apply capacity parameters to size the piping system; Subsequently identify the part numbers of the sized system's components in the Material Size Catalog; Store part numbers in the Ship Estimate Data Base.
- Costing and Pricing Subsystem (Figure 3) is then employed to generate estimate. Component materials costs may come from direct historical prices (found in the Historical Material Requirements Library) escalated using Commodity Price Indices, to some date in the future, most recent buy price, etc. Established component costs to be used on a given estimate may be saved in the Material Parts/Price Catalog. Labor estimates based on the material lists are generated using estimator-specified man-hour ratios (man-hours/unit of measure). Man-hour totals may optionally be spread over time using an estimator-specified construction S-curve. Overhead, profit and other pricing factors may then be applied to establish estimate price.

4. Integrated Hull Form Design

- Purpose is development of an industry-consensus specification for hull form design software; identification and subsequent modification of existing software to meet these specifications.
- Specification covering Hydrostatic, Intact and Damage Stability, Floodable Length, Tank Capacities, Longitudinal Strength and Launching Calculations has been distributed to the projects Advisor Group for review and will subsequently be distributed for industrywide review and comment.

IV. F.Y. 1981 - PROJECTS

1. Product Information System - Task 1: Structural Information Requirements

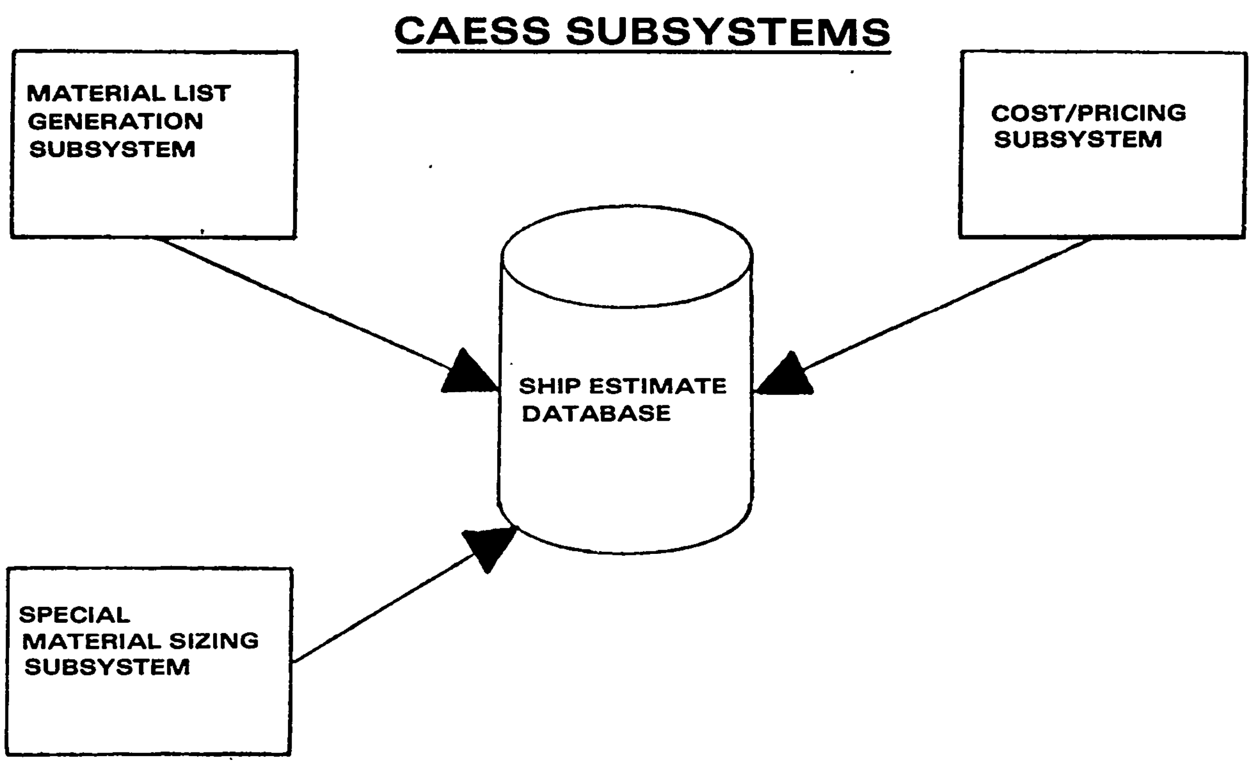
- Objective is to document the items of information and their relationships used in the functions of structural preliminary and detailed design, lofting, planning and production.
- Shipyards will prepare functional descriptions for these areas.
- Information items and relationships will be identified from these descriptions and documented in terms of a conceptual data base design for future use by structural applications systems.

2. Space Arrangements Using Interactive Graphics

- NASSCO is project sponsor and will develop specifications in Phase I of the project for a system to allow designers from various design groups to define system and component layouts within a space and product composite arrangement drawings.
- Phase II of the project will be the development/implementation of all or a portion of the Phase I - specified capabilities.

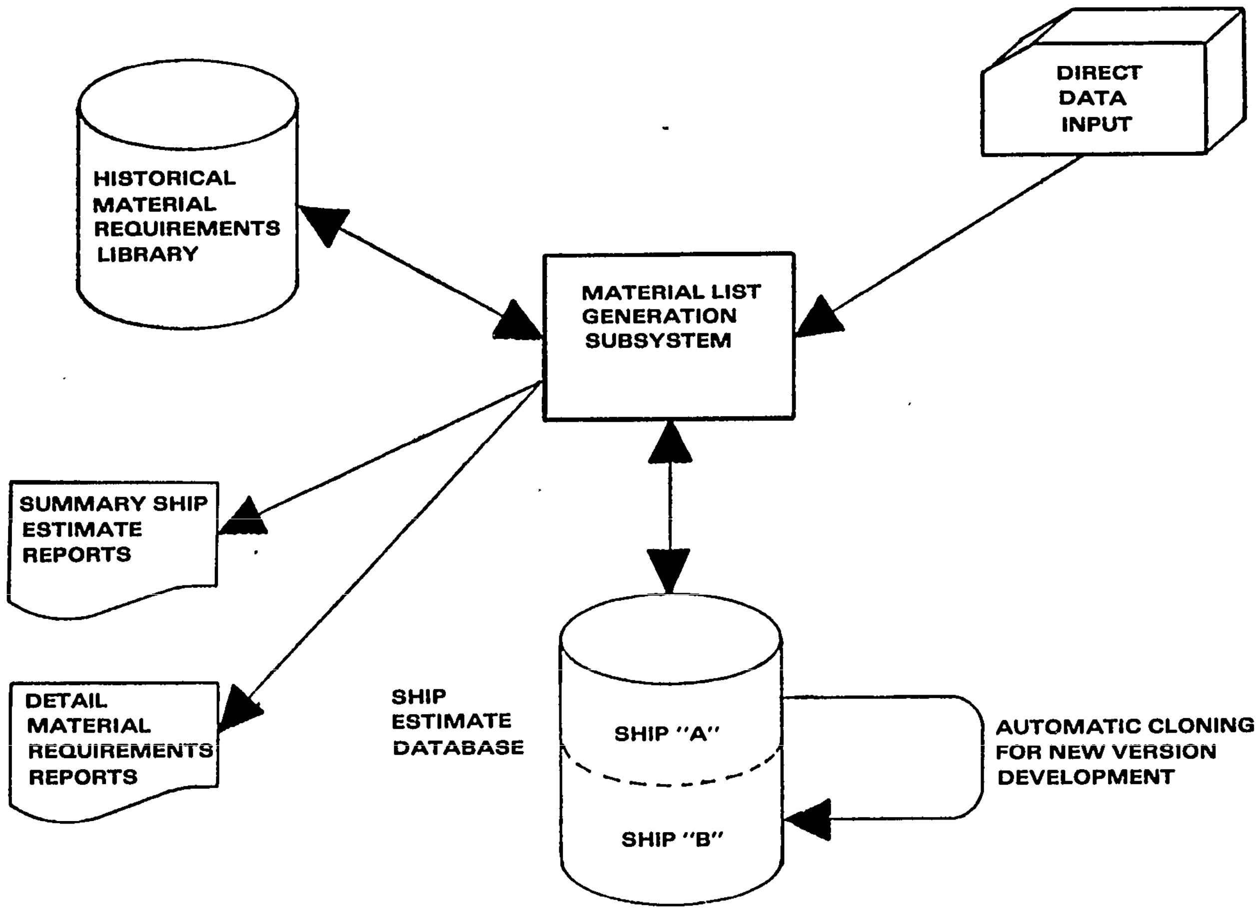
3. Modular Shipbuilding Information System

- As part of its REAPS functions IITRI will further investigate the development of a prototype information system which supports zone-based planning, design and production.
- This task will make use of the results of ongoing investigations by Ship Production Committee panels SP-2 and SP-6 and the Levingston-IHI Technology Transfer Program.



The Computer Aided Estimating System for Shipbuilding CAESS is being developed by National Steel and Shipbuilding Co. The objective of this effort is to provide a computer based tool for use by estimators which assists them in managing the large quantities of information used in preparing a contract estimate. The prototype system, depicted here, includes software for generation of material lists and cost estimates for steam propulsion plants. However, the material list generation methodology is applicable to the entire ship as is the application of the independent cost/pricing subsystem.

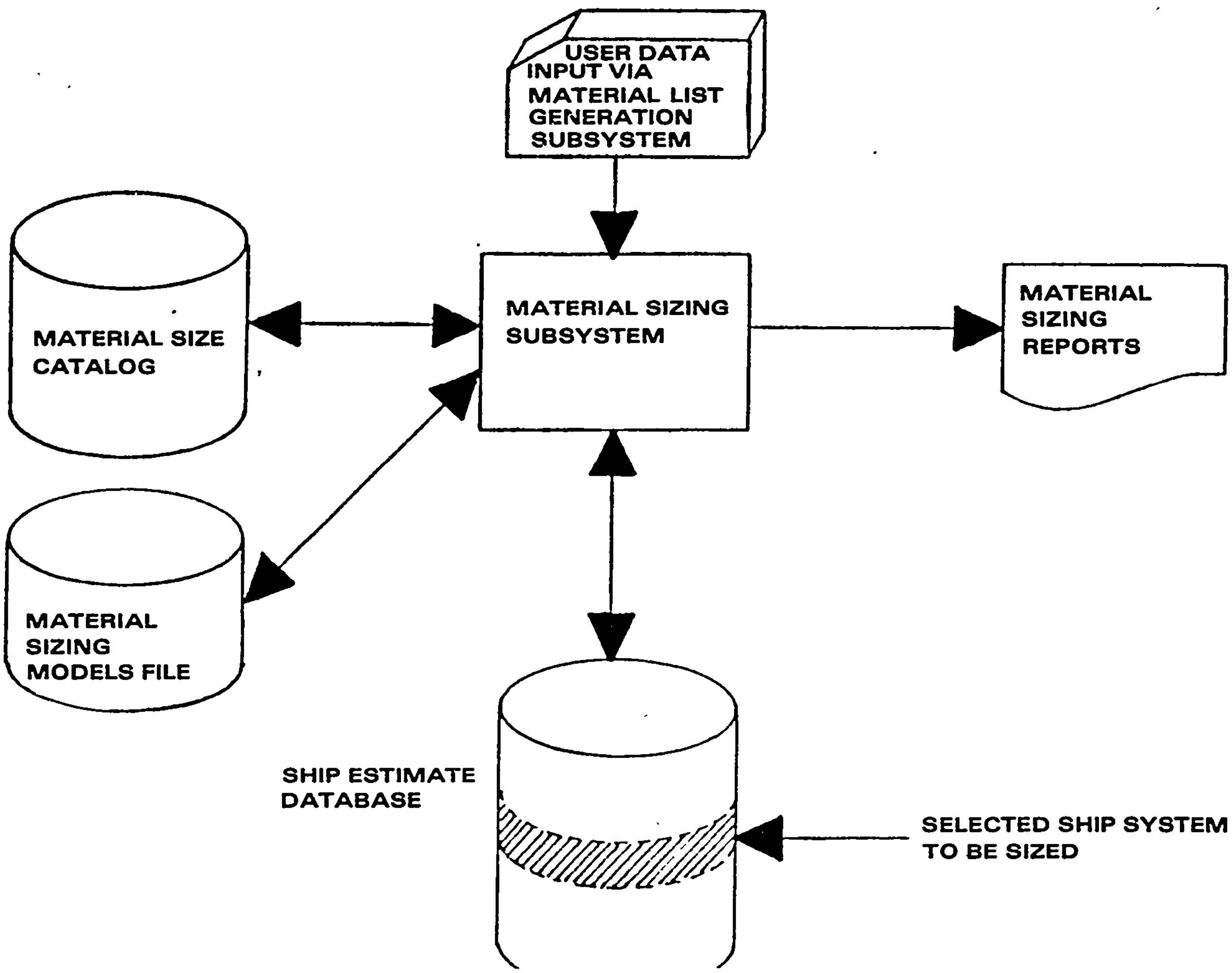
MATERIAL LIST GENERATION SUBSYSTEM



The material list generation subsystem is used to build and edit or update a set of system material lists. Sources of material list information for a given system can be: 1) user input; 2) historical data; or 3) direct copying of an existing system already on the estimate data base or combinations of these.

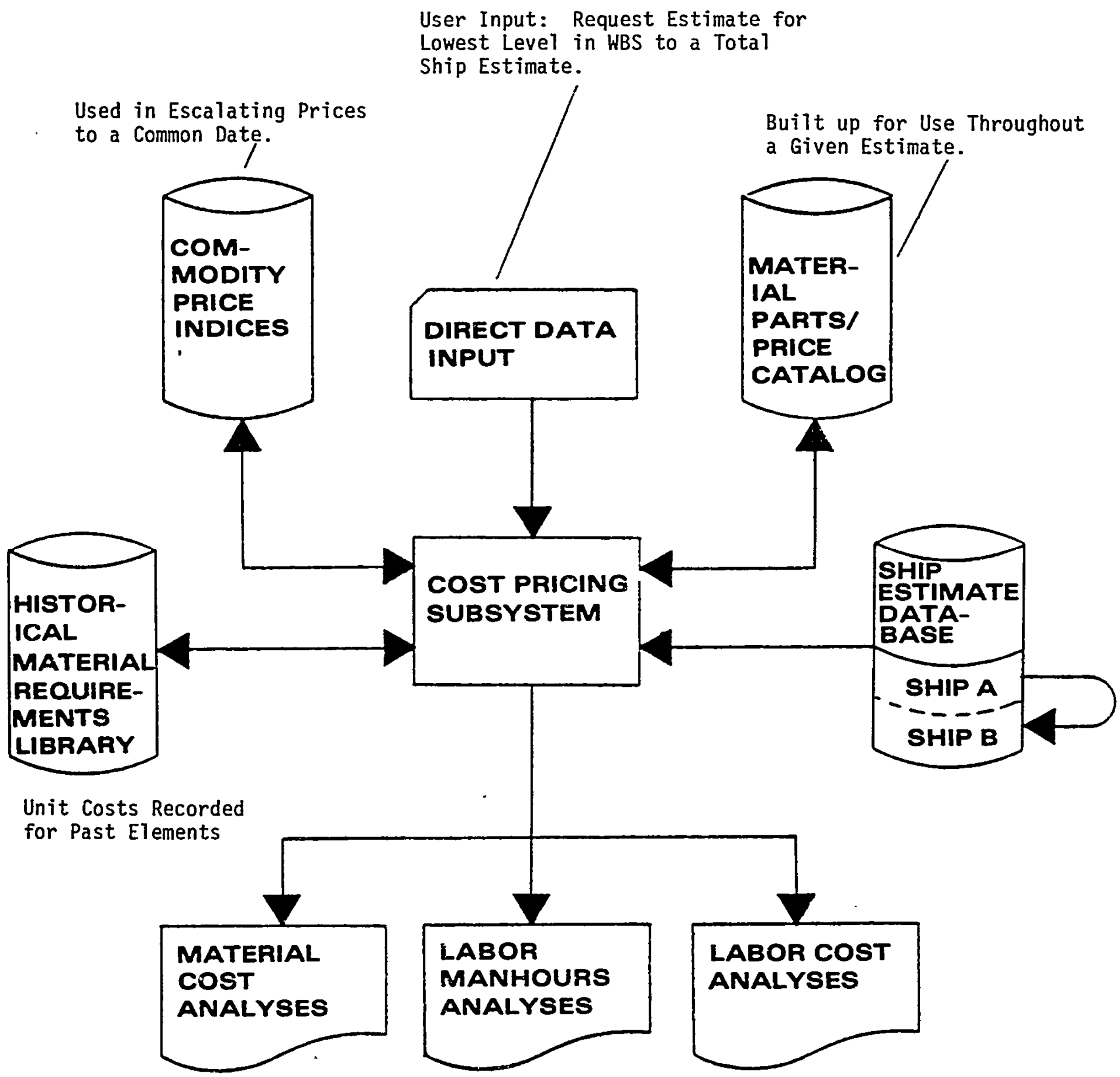
The prototype system's material, sizing subsystem will be a pipe sizing program. In operation the software will extract information on the desired unsized system model from a library of such models, apply capacity parameters to size the material, and, once sized, identify the resulting part numbers of the material from the Material Size Catalog for storage in the Estimate File.

MATERIAL SIZING SUBSYSTEM



Labor estimates derived by applying estimator supplied rates to the appropriate material item quantities to produce labor content to which is applied estimator specified hourly rates. Total labor may be optionally spread overtime by applying an estimator-specified construction S-curve. Overhead and profit rates along with other pricing factors will be applied to allow a total dollar estimate to be generated.

COST PRICING SUBSYSTEM



THE SHIP PRODUCIBILITY RESEARCH PROGRAM
OVERVIEW AND STATUS

John C. Mason
Program Manager
Ship Producibility Research Program
Bath Iron Works Corporation
Bath, Maine

Mr. Mason is program manager for the joint Bath Iron Works/Maritime Administration Ship Producibility Research Program. He also serves as chairman of the Society of Naval Architests and Marine Engineers (SNAME) Panel SP-6 on Standards and Specifications and Panel SP-8 on Industrial Engineering, as secretary of the American Society for Testing and Materials (ASTM) Committee F-25 on Shipbuilding, and is a member of the SNAME Ship Production Committee.

Mr. Mason holds a degree in mechanical engineering from the U.S. Naval Academy and a degree in administration/management engineering from George Washington University.

ABSTRACT

This paper describes the Ship Producibility Research Program, the Bath Iron Works Corp. sponsored element of the Maritime Administration's National Shipbuilding Research Program. The material is presented in three parts:

Part I - Introduction and Background
Part II - The Shipbuilding Standards & Specifications Program
Part III - The Shipbuilding Industrial Engineering Program

THE SHIP PRODUCIBILITY RESEARCH PROGRAM

OVERVIEW AND STATUS

Part I - Introduction and Background

Introduction

Since 1973, Bath Iron Works Corporation has sponsored the Ship Producibility Research Program, one of several elements of the Maritime Administration's National Shipbuilding Research Program. In 1977 it was decided that industry needs and program objectives could best be served by focusing program efforts in two principal areas: (1) Shipbuilding Standards and Specifications, and (2) Shipbuilding Industrial Engineering. During the past three years, significant progress has been made in both areas through the efforts of two new technical panels (SP-6 on Standards & Specifications and SP-8 on Industrial Engineering) under the SNAME Ship Production Committee, working in close cooperation with the American Society for Testing and Materials (ASTM) and the American Institute of Industrial Engineers (AIIE) respectively.

The objective of this paper is to summarize the background, accomplishments to date, current activities, and future plans of the Ship Producibility Research Program.

Background

Between 1973 and 1976 several research projects were conducted under the original Ship Producibility Program concentrating on standardization, improved design and improved shipyard operation. As these initial efforts were completed, it became increasingly apparent

that there were two common denominators for optimizing shipyard productivity improvement. First, the early attempts to develop shipbuilding standards clearly indicated the significant potential of such an approach and the requirement for a nationally coordinated program for standardization in shipbuilding to be successful. Secondly, it was recognized that the various approaches to improved shipyard operations involved many direct functional applications of the discipline of industrial engineering, e.g. methods improvement, work measurement, production control, quality control, facilities, production engineering, etc. Accordingly, efforts began in late 1976 to effectively re-direct the Ship Producibility Research Program to focus on these two areas beginning with the shipbuilding standards and specifications program.

The following events highlight the development of the National Shipbuilding Standards Program:

Castine Conference (June, 1976)

This conference on standards for the U.S. shipbuilding industry was attended by representatives from shipyards, various standards organizations, government and regulatory agencies. The objective of the session was to review the use of standards in other industries and in foreign shipbuilding, to discuss the potential benefits of standardization, and to assess industry interest in supporting a major new U.S. initiative.

The conferees concluded that the development of standards for design, production and procurement was technically and economically feasible, and that a national program should be implemented.

Reactivation of SNAME Panel SP-6 (November, 1977)

SNAME Panel SP-6 on Standards & Specifications was reactivated to serve as the industry's steering committee for the National Shipbuilding Standards Program. Initial MarAd sponsored standards development projects were identified and ASTM was selected as the appropriate forum for ongoing standards development and maintenance.

ASTM Planning Meeting (January, 1978)

Thirty-five representatives from all segments of the shipbuilding industry (shipyards, owners, design agents, vendors, ABS, USCG and the U.S. Navy) met at Philadelphia and agreed that a new ASTM committee on shipbuilding should be formed.

ASTM Organizational Meeting (June, 1978)

More than 175 representatives from every segment of the shipbuilding industry met at Philadelphia and formally established ASTM committee F-25 on Shipbuilding.

The significant accomplishments to date, current activities, and future plans of the shipbuilding standards and specifications program are summarized in detail in Part II of this paper.

In early 1978, the Ship Producibility Research Program and the American Institute of Industrial Engineers sponsored a Shipbuilding Industrial/Production Engineering Workshop which confirmed the feasibility of significant productivity improvements in shipyards through the application of proven industrial engineering techniques. In that same year, the Industrial Engineering Panel (SP-8) was established under the SNAME Ship Production Committee to serve as the shipbuilding industry's principal advisory group for implementation of the workshop's highest priority consensus recommendations. The number one priority identified was the application of basic methods engineering and work measurement techniques.

In late 1979 work on this high priority area commenced with the Phase I Shipyard Methods/Labor Standards Development Program, involving six major shipyards and H.B. Maynard & Co., Inc. - a world leader in management and industrial engineering consulting. At the same time, programs were initiated to increase shipyard management awareness of industrial engineering through (1) a series of AIIE executive briefings, and (2) a series of shipyard production control workshops.

The very significant accomplishments to date, current activities, and future plans of the shipbuilding industrial engineering program are summarized in detail in Part III of this paper.

SP-6 -THE SHIPBUILDING STANDARDS AND SPECIFICATIONS PROGRAM

Samuel Wolkow
Project Engineer
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Mr. Wolkow is a project engineer responsible for administration of the standardization portion of the Ship Producibility Research Program, and also serves as secretary of SNAME Panel SP-6.

Mr. Wolkow attended New York University, majoring in mechanical engineering, is a registered professional engineer, and has more than 40 years experience in,the shipbuilding industry.

Part II - The Shipbuilding Standards & Specifications Program

Role: The principal role of SNAME Panel SP-6, "Standards & Specifications," is to coordinate the National Shipbuilding Standards Program effort. Additionally, SNAME Panel SP-6 and the BIW/MarAd sponsored program play an important role in providing a "pump-priming" function for voluntary standards development of ASTM Committee F-25 on Shipbuilding. As a result, MarAd/Industry support has accelerated the development of 3-4 times as many standards as would be possible through strictly voluntary consensus action. It has been conclusively demonstrated that a coordinated effort to develop, maintain, and apply shipbuilding standards is necessary for the U.S. shipbuilding industry.

Scope: The scope of Panel SP-6 is to act as the U.S. shipbuilding industry's steering committee for the National Shipbuilding Standards Program and to set shipyard plans and priorities for standards development, and through the SNAME Ship Production Committee, recommend cooperative MarAd/Industry cost-shared projects which will accelerate direct benefits to the industry.

Recently, more shipyards are expressing an interest in participating in MarAd cost shared projects to adopt and implement innovative approaches to shipbuilding techniques, e.g., zone outfitting, accuracy control, pre-outfit module construction, etc., and in every instance, standards have surfaced as an essential component of the more productive systems.

Membership: Since its activation late in 1977, membership on SNAME Panel SP-6 has increased to ten major shipyards plus senior management personnel from the U.S. Navy (NAVSEA) and the Maritime Administration.

It is significant that several of the existing member shipyards are placing increased emphasis on standardization activities, and many other yards either have or are planning to initiate internal standards programs.

It is anticipated that as many as 4-6 additional shipyards will have applied for formal membership on SNAME Panel SP-6 by the time this presentation is made.

CURRENT MEMBERSHIP SNAME PANEL SP-6

Avondale Shipyards	Quincy Shipbuilding Division
Sun Ship, Inc.	Bethlehem Steel/Sparrows Pt.
Maritime Administration	Davie Shipbuilding, Ltd.
Wiley Manufacturing Co.	NASSCO
NAVSEA	Newport News Shipbuilding
Levingston Shipbuilding	Bath Iron Works Corp.

Prospective New Members

Litton Industries Ingalls Shipbuilding Division	General Dynamics Corp. Electric Boat Co.
Marinette Marine Corp.	Bay Shipbuilding Corp.
Peterson Builders, Inc.	Tacoma Boatbuilding Co.

Prospective members have been reminded that the benefits that can result from cooperative Maritime/Industry cost shared projects are significant, ranging from keeping current on progress and developments to actively participating in MarAd funded projects which not only serve industry needs but also have direct application for the individual yard involved.

ASTM Committee F-25

Role: First, the American Society for Testing and Materials (ASTM) is simply a non-profit management system for the development of voluntary consensus standards. The ASTM staff itself numbers fewer than 100 people and, in fact, voluntary industry representatives serving on the Committee are ASTM. In the late 1960's the ASTM charter was modified to include the development of standards for products, systems, and services in addition to the more familiar material standards such as specifications for steel, non-ferrous metals, plastic, etc. It should also be noted that ASTM is the world's largest source of voluntary consensus standards and that all ASTM standards are submitted to ANSI[2] (the American National Standards Institute) for parallel approval as American National Standards (formerly ASA standards). Recognizing the problem of semantics surrounding the word "standard," ASTM well uses it as an adjective in conjunction with five types of standards - specifications, practices, definitions, classifications, and test methods.

[2]ANSI is not in the business of writing standards, but performs the function of national coordinator; ASTM is the major standards writing organization.

Scope: The scope of Committee F-25 on Shipbuilding is to develop standard specifications, test methods, definitions and practices for design, construction, and repair of marine vessels. The committee will coordinate its efforts with other ASTM committee and outside organizations having mutual interests.

Membership: On May 31-June 1, 1978 over 175 senior representatives from all segments of the shipbuilding industry (shipbuilders, owners/operators, design,agents, major vendors, regulatory and government agencies, and academia) met at ASTM Headquarters in Philadelphia and officially organized the new ASTM Committee F-25 on Shipbuilding.

To date, about 180 individuals have established official membership status. In many instances several people from a single organization actively participate in committee activities behind the one official representative.

The current slate of officers and the organization of Committee F-25 is summarized below:

OFFICERS

Chairman	R. J. Taylor	EXXON International Co.
1st Vice Chairman	E. A. Schorsch	V.P. Bethlehem Steel Co.
2nd Vice Chairman	Radm. E. J. Otth	USN NAVMAT
3rd Vice Chairman	H. F. Greiner	Sealol, Inc.
Secretary	J. C. Mason	Bath Iron Works Corp.

SUBCOMMITTEE OFFICERS

F-25.01	Materials	J. C. West	Beth. Beaumont
'F-25.02	Coatings	*T. Krehnbrink	Sun Ship, Inc.
F-25.03	Outfitting	N. M. Stiglich	Eness R & D Corp.
F-25.04	Hull Structure	T. Krehnbrink	Sun Ship, Inc.
F-25.06	Ship Control & Automation	F. J. Kennedy	NAVSSES PHILA
F-25.07	General Support Requirements	S. H. Bailky	Avondale Shipyards
F-25.08	Deck Machinery	D. G. Pettit	NAVSEA
F-25.10	Electrical/Electronics	F. E. Anderson	NAVSEA
F-25.11	Machinery	B. J. Walsh	NAVSEA
F-25.12	Welding	*S. Morrison	General Dynamics/E.B. co.
F-25.13	Piping	H. F. Greiner	Seal01

*Interim Status

Current Status

SNAME/MarAd/Industry Program

This program derives its impetus from the cooperation provided by participating members of the shipbuilding industry acting through the Society of Naval Architects and Marine Engineers' Ship Production Ccmmittee in recommending projects to be accomplished under a cost sharing plan administered by the Maritime Administration and managed by major sponsoring shipyards.

Bath Iron Works Corporation, as manager of the Ship Producibility Program, currently has under contract with five leading U.S. shipyards twelve separate projects which comprise over fifty individual tasks. These involve such elements as Shaft Alignment Standards (3), Construction Standards Group I (9), Mechanical Design, Construction Standards Group II (8), HVAC Design/Construction Standards (10), Outfit Construction Standards (6), Standard Piping Material Schedule,

Construction Tolerance Standards, Weld Defect Tolerance Study, Standards Program Long Range Plan, Mechanical Design/Construction Standards Group III (7), Standard Piping Diagrams (2), QA/QC Standards, and Development of Industry Standards (5) (Note 1).

It is becoming increasingly apparent as the standards program develops that short term accomplishments are providing support and momentum for long range goals and objectives.

For example, in June, 1980, Dr. Les Sandor of Sun Ship, Inc. completed a work (Task S-22) on "Weld Defect Tolerance Study." As a result of his investigations, Dr. Sandor proposes a fitness for purpose approach for resolving the problem of correcting welding deficiencies by such innovative concepts as Quality Band and Quality Control Systems Loop. Dr. Sandor's study provides a definitiire analysis of weld discontinuities on the vessel's structural integrity and concludes that the preponderance of weld repair activity in the commercial sector of the U.S. Shipbuilding Industry involves slag inclusions and porosity, which have the least harmful effect on the hull structure. He therefore proposes that first priority be given to the establishment of new, improved weld acceptance standards with regard to these defects. Accordingly, efforts have been jointly undertaken by SNAME Panels SP-6 and SP-7 in conjunction with ASTM technical subcommittee F-25.12 (Welding) to start development of a draft standard based on Dr. Sandor's work. It is estimated that savings amounting up to $1 million/ship can be realized by eliminating the need to correct such innocuous weld defects as slag and porosity.

Note 1 - The individual status of all standards being developed under the SNAME/MarAd program is summarized in attachment (1) hereto.

Another project currently underway involves a study of construction tolerance standards (Task S-21A) also under subcontract to Sun Ship, Inc. The scope of work for this task is to investigate and summarize the effect of fit-up problems, alignment, and unfairness on the integrity of the hull structure, also on a fitness for purpose philosophy. The result of this work is expected to provide the basis for a follow-on contract intended to produce standards defining acceptable construction tolerance criteria. It is further anticipated that this study will lead to an investigation of rework requirements involving cosmetic repairs which are highly labor intensive and time consuming to accomplish, and like slag and porosity weld defects, have little or no harmful effect on the integrity of the hull structure. An estimate of savings that can be achieved by eliminating rework of a cosmetic nature amounts to several million dollars/ship.

Future Plans

The long range plan for FY-80 (Task S-29) is intended to be the most ambitious and intensive effort attempted to date in the U.S. Standards Program. Its scope and magnitude focuses on a program designed to develop a new generation of standards addressing shipyard/ industry needs and priorities.

Since it is percieved to be a pre-accepted industry consensus plan, active coordination with both SNAME Panel SP-6 and ASTM Committee F-25 will be required to determine specifically what the thrust and direction of the effort shall be, priorities to be ordered, actions required and responsibilities to be assigned.

The rationale for this project derives from the success of the IHI/Levingston Technology Transfer Program, the benefits gained and advantages realized from pre-outfitting, zone outfitting and modular construction techniques, and the conclusions reached from the 1979 Ship Production Committee survey of Japanese shipbuilding technology.

As suggested in the paper presented to the Metropolitan Section (NYK) of SNAME by Messrs. Tim Colton and Yukinori Mikami, the long range plan will probably address standards development in such areas as engineering and design procedures, planning and production control processes, facilities and industrial engineering techniques, quality assurance, and perhaps even industrial employment methods. BIW as the lead yard/program manager will select proposals from major Japanese shipyard/consulting firms to survey U.S. yards, organizations, facilities, personnel and practices. The result will be to suggest standards development/priorities needed to support an ongoing long range plan to optimize both near and long term benefits, which will generate industry-wide participation and support. The intention of Panel SP-6 is to focus the program on shipyard application, addressing such areas as zone outfitting, pre-outfit module construction, accuracy control, quality control, etc.

V. Current Status - ASTM Voluntary Standards Development

Development of consensus standards within formal due process requirements of ASTM is a deliberate and time-consuming process.

Initially, a task group of 2-5 people is formed to do the necessary investigative work and then prepare an initial draft which is reviewed by the cognizant technical subcomittee through a balloting procedure.

If the draft is approved by two-thirds of those returning their ballots (a minimum of 60% of boting interests must return ballots), the document proceeds to the main committee ballot. Here 90% of those returning ballots (and again a 60% return is required) must approve the document. It then proceeds to the Society ballot where a minimum of 50 ballots must be cast and a 90% affirmative vote is required to make it an approved ASTM standard.

A single negative ballot at any stage of the process returns the proposed standard to the originating technical subcommittee for resolution.

This procedural description provides greater significance to the advanced status of the ASTM voluntary standards development and also emphasizes the role of the BIW/MarAd program and SNAME SP-6 activities in accelerating standards availability to the industry (Note 2).

Note 2 - The individual status of all standards now being voluntarily developed by ASTM Committee F-25 is summarized in attachment (2) hereto.

On July 3, 1980, Sam Bailey of Avondale Shipyards, Inc. had the distinct honor of developing the first standard to complete the Society balloting procedure. This standard, for a five and ten gallon engineer's oil dispensing tank, will be published in the ASTM 1981 edition of the Book of Standards, Part 46 (Sub. 07).

Coincidentally, the ASTM Committee on Publications intends to restructure the Annual Book of ASTM Standards, 1982 edition, from 48 to 63 parts. By that date, Committee F-25 will have met the minimum requirements for having its own Book of Standards assigned, and has formally notified the Publications staff of this fact.

VI. Future Plans

In May, 1980, Committee F-25 held its semi-annual meeting in Denver, CO. A unique feature of this meeting was a shipbuilders' workshop which was designed to provide a forum for shipyard representatives to present their problems, concerns, and recommendations for standards development priorities to the Main Committee and technical subcommittees for their review, consideration, and action. This workshop proved to be so productive and mutually beneficial to all concerned, that similar workshops are being planned for ship owners/operators and design agents. As the MarAd/Industry long range plan matures, it is anticipated that numerous recommendations will cascade to Committee F-25 for due process development as National standards. ASTM, as the National Standards writing organization, validates the efforts of SNAME Panel SP-6 and provides national recognition and prestige to the shipbuilding standards effort.

The long range goals of Committee F-.25 formulated at the May, 1980 meeting in Denver were defined as:

- Developing and elucidating a policy position regarding Government participation in the work of F-25.

- Coordinating the development of long range planning goals and objectives with SNAME Panel SP-6.

- To increase emphasis on public relation activation:
  NSSP Status Report No. 1
  Weld Defect Tolerance Study ASNT Journal
  Adm. Lisanby/John Haas paper in ASNE Journal
  ASTM Book of Standards - Shipbuilding
  ABS Surveyor
  ASTM/SNAME October, 1981 Symposium

VII. U.S. Navy Participation/Support

The Navy Department's participation in the voluntary consensus standards program is most encouraging and supportive and is worthy of special commendation. The Navy Department has fully complied with the spirit and intent of the directives contained in OMB-A119.

As an example, the Navy is currently studying the standards program with the view towards official DOD acceptance and eventual inclusion in the Navy General Specifications for Building Ships. Further to this effort, Admiral Lisanby and Mr. John Haas have written a paper on commercial standards application to Naval Design and Construction procedures. Also, NAVSEA has established a new office in the Shipbuilding Directorate that is chartered to improve the quality and reduce the cost of repair and construction in the private and public sector ship repair and construction activities. The Director of the new office is Capt. Robert Christensen, USN.

Other activities that the Navy has underwritten in support of the ASTM voluntary standards development program include:

- The establishment of a Hull and Machinery engineering forum to discuss industry needs and how these needs can best be served.
- Reactivation of the ASME Boiler marine conference.
- Participation and representation on all F-25 technical subcommittees and most SNAME activities.

VIII. OMB Circular Letter A119

OMB-A119, "Federal Participation in the Development and Use of Voluntary Standards" provides executive branch policy for agencies working with voluntary standards developing bodies. It also establishes policy to be followed in adopting and using such standards in procurement activities.

OME-A119 states the general policy of the Federal Government is to:

- Rely on voluntary standards with respect to Federal procurement whenever possible and consistent with the law.
- Participate in activities of voluntary standards bodies when such is in the public interest.
- Coordinate agency participation in voluntary standards bodies to insure maximum effectiveness of participation.

OMB-A119 establishes criteria for identifying voluntary standards developing bodies that meet minimum requirements for-due process:

- List of accredited organizations to be maintained by the Secretary of Commerce.
- Listing is precondition to Federal participation.
- Basic requirements are: open access to participation; advance notice; due process; and adequate recordkeeping procedures.

OMB-A119 emphasizes that voluntary standards are to be given preference in government procurement activities.

SP-8 -THE SHIPBUILDING INDUSTRIAL ENGINEERING PROGRAM

Joseph R. Fortin
Project Engineer
Ship Producibility Research Engineer
Bath Iron Works Corporation
Bath, Maine

Mr. Fortin is a project engineer responsible for administration of the industrial engineering portion of the Ship Producibility Research Program, and also serves as secretary of SNAME Panel SP-8.

Mr. Fortin holds a degree in marine transportation from the Massachusetts Maritime Academy.

PART III - THE SHIPBUILDING INDUSTRIAL ENGINEERING PROGRAM

Introduction

As a result of the three-day Atlanta Workshop in 1978, the Shipbuilding Industrial Engineering Panel SP-8 of the Society of Naval Architects and Marine Engineers was established to act as the shipbuilding industry's steering committee for a national industrial engineering effort. Specifically, SNAME Panel SP-8 was tasked to:

- Establish a consensus priority list of problem areas for a solution:
- Solicit and review proposed industrial engineering research projects which address the problem areas;
- Provide,continuing program guidance and overview;
- Publish and disseminate research results to the industry and aid in the understanding of such results:
- Maintain a flexible and continuing program with built-in redirection capability to address new problems as they arise;
- Maintain an up-to-date awareness of shipbuilding and industrial engineering technology;
- Schedule annual technical meetings for industrial engineers in shipbuilding;
- Develop and organize a program of training for shipyard management and industrial engineering.

Two consensus high priority areas selected by SNAME Panel SP-8 for immediate action were (1) Methods Engineering/Labor Standards Development and (2) generally increasing shipbuilding management awareness of the scope and potential of basic industrial engineering techniques in shipbuilding.

Membership: SNAME Panel SP-8 is made up of approximately 25 active members who represent both the large and small shipyards in the United States. Represented are: Bath Iron Works, National Steel & Shipbuilding, Newport News Shipbuilding, Bay Shipbuilding, Peterson Builders, Bethlehem Steel/Sparrows Point, Sun Ship, Jeffboat, Equitable Shipyards, Levingston Shipbuilding, Wiley Mfg., Avondale Shipyards, Marinette Marine, and Norfolk Shipbuilding & Drydock.

Panel members meet regularly to coordinate their efforts and set goals and priorities for the industrial engineering program. With significant support from the Maritime Administration, the panel has implemented priority programs toward the goal of increased productivity through the application of basic industrial engineering concepts.

As priority number one, Phase I of the Shipyard Methods/Labor Standards Development Program was implemented in late 1979. It was recognized that the necessary expertise for a comprehensive labor standards development program did not currently exist within the shipbuilding industry. Therefore, proposals were solicited for the performance of an effort that would result in a coordinated labor standards development program tailored to the needs of the shipbuilding industry.

The H. B. Maynard and Co. proposal was selected as the best suited to meet the needs of the program. The purpose of their effort was to provide training and consulting services for the six initial shipyards to develop predetermined motion time system standards using the Maynard Operation Sequence Technique (MOST) System. Significant productivity improvements were anticipated through the development and application of these methods/process

standards.

The participating yards and functional areas addressed during Phase I are:

BIW - Fabrication and sub-assembly

NASSCO - Panel line and sub-assembly

Bay Ship - Hull erection

PBI - Pipe shop

Sun Ship - Blast & paint shop

NNS - Development of the maxi MOST system

One of the products of this program will be a published Work Management Manual for each functional area. These manuals will be shared by participating shipyards, thereby accelerating industry-wide application and benefits.

While the'labor standard data developed during this phase of the program will ultimately provide an extremely valuable input in such areas as planning, scheduling and production control, benefits from methods improvement have already been realized. Ecr example:

- 25 to 30% productivity improvement in crane utilization from the use of time studies to identify delays. As a result, more emphasis was placed on planning the crane moves and the riggers were prompted to be better prepared and set up for each crane usage.

- 10 to 40% productivity improvement in the shipboard assembly and installation area. This resulted from methods analysis performed while defining the process used in work measurement. The end result was using the most efficient process which also established proper manning requirements and a better definition of material requirements, palletizing, and staging needs. The productivity improvement figure was derived from measurement of the process both before and after methods improvements.

- 15% productivity improvements were realized in the foundation assembly area. Some examples of methods improvements contributing to this overall productivity improvement rate are:

- Installation of jib cranes to service work tables to eliminate the delays caused by using the bridge crane.
- Setting up a clipboard logging system for fabricated parts replacing random storage, thus improving the flow of parts to the assembly work area.
- Method change in fabrication of deck beam cutouts from burning to more efficient punching out of cutouts with a punch press. This process also reduces slag grinding time at assembly.
- Switching from stick welding to more efficient fluxcore welding with the introduction of new fluxcore equipment.
- Relocation of various equipment and work benches to allow a better flow of material.

These conservative estimates from actual shipyard documentation are but a sampling of some of the more obvious methods improvements made during the initial phase of the program.

Phase II of the Shipyard Methods/Labor Standards Development Program (1981) will be a follow-on to Phase I with several significant additions. First, Bethlehem Steel/Sparrows Point has been added as the seventh shipyard actively participating, and seven new areas have been selected for detailed methods engineering review and development of labor standard data. Phase II yards and task areas include:

BIW - Main Assembly

NASSCO - Plate Shop

NNS - Blast & Paint/Platen & Dock/Maxi MOST

Sun Ship - Sheetmetal Shop

Bay - Application & Transferability of WMM's

Peterson - Electrical Shop

BSC/SP - Temporary Staging

Secondly, Phase II will also include a one-year test and evaluation period for the H. B. Maynard & Co. MOST Computer System. It is anticipated that this system will greatly enhance the industrial engineer's capability to develop, maintain, **and** update standards as new methods or changes occur. Some additional anticipated benefits are:

- Improving the productivity of the I.E.
- Generating uniform information and data for faster, more consistant production planning and control.
- Increasing savings/cost ratio for the I.E. function and profitably for the shipyards.

By the end of Phase II it is anticipated that sufficient justification will have been provided for participating shipyards to sustain ongoing methods/standards programs. Preliminary implementation plans are now being developed to ensure the maximum benefit from the standard data being generated in each yard.

The second consensus high priority area selected by SNAME Panel SP-8 was "generally increasing shipbuilding management awareness of the scope and potential of application of basic industrial engineering techniques in shipbuilding." To this end, a professional presentation entitled "Industrial Engineering Applications in Shipbuilding" has been developed by the American Institute of Industrial Engineers (AIIE) to support the program. These presentations are being provided in the form of executive briefings to upper and middle management throughout the shipbuilding industry. The four principal objectives of these presentations are:

1. To briefly describe industrial engineering and its relationship to productivity improvement.

2. To describe in some detail the most cost effective industrial engineering approaches and priorities for implementation.

3. To indicate to management the support required and benefits which should be anticipated from implementation of various techniques.

4. To highlight progress already being made through application of methods engineering and work measurement techniques.

Another priority project included in Phase I of the program is the development of a two-day Production Control Workshop. This workshop is based on the"Manua1 on Planning and Production Control for Shipyard Use" published by the Ship Producibility Research Program in 1979, and it will be offered to several interested shipyards during late 1980 and early 1981.

The primary objective of these workshops is to relate production control to industrial engineering and to provide specific guidance for follow-on implementation of labor standard data.

Finally, another significant area being coordinated by SNAME Panel SP-8 is Accuracy Control. Recently, a special task group on accuracy control has been established with the primary objective of gathering, correlating, and disseminating relevent data to interested yards.

In summary, significant accomplishments are being achieved through the hard work and dedication of SNAME Panel SP-8, all made possibly by the backing and support of the Maritime Administration and AIIE. In the immediate future, this program promises to contribute continued productivity improvement in the shipbuilding industry through the priority application of industrial engineering techniques.

NATIONAL SHIPBUILDING STANDARDS PROGRAMS

DATE: SEPT. 1980

STATUS OF SNAME/MARAD SPONSORED SHIPBUILDING STANDARDS PROGRAMS

PROGRAM	SPONSOR	STATUS						REMARKS
		TECHNICAL DEVELOPMENT	DRAFT	F25 SUB-BALLOT	F25 BALLOT	ASTM BALLOT	FINAL PUBLICATION	
SHAFT ALIGNMENT STANDARDS	TASK S-21							
I. GEARED STEAM TURBINE; INBOARD SHAFTING	SUN/F-25.11	OCT. 1978	OCT. 25, 1979	JAN. 9, 1980				
II. SLOW SPEED DIESEL, INBOARD SHAFTING	SUN/F-25.11	FEB. 1979	JUNE, 1980					
III. GEARED STEAM TURBINE; OUTBOARD SHAFTING	SUN/F-25.11	JULY 1979	APRIL 1, 1980					
CONSTRUCTION STANDARDS, GROUP I	TASK S-23							
SLEEVE TYPE PIPE COUPLINGS	BIW/F-25.13	SEPT. 29, 1978	FEB. 2, 1979	APRIL 30, 1979 & MARCH 24, 1980	NOV. 19, 1979 & MARCH 24, 1980	JUNE, 1980		
MODULAR GAGE BOARDS	BIW/F-25.13	SEPT. 29, 1978	FEB. 22, 1979	JULY 16, 1979	MARCH 3, 1980			
GAGE PIPING ASSEMBLIES	BIW/F-25.13	SEPT. 29, 1978	FEB. 18, 1979	SEPT. 24, 1979 & MARCH 3, 1980	JULY 25, 1980 MARCH 3, 1980			
WELD JOINT DESIGN FOR SHIPBOARD PIPING	BIW/F-25.13	SEPT. 29, 1978	MARCH 9, 1979	SEPT. 24, 1979	MARCH 3, 1980			
USE OF BRANCH CONNECTIONS	BIW/F-25.13	SEPT. 29, 1978	MARCH 14, 1979	JULY 16, 1979	MARCH 3, 1980	JUNE, 1980		
SELECTION & APPLICATION OF THERMAL INSULATION ON PIPING & MACHINERY	BIW/F-25.13	SEPT. 24, 1978	JUNE 29, 1979	NOV. 12, 1979	MARCH 3, 1980	JUNE, 1980		
DESIGN & INSTALL. OF RIGID PIPE HANGERS	BIW/F-25.13	SEPT. 29, 1978	AUG. 27, 1979	NOV. 26, 1979	MARCH 3, 1980			
GUIDELINES FOR CLEANING/FLUSHING SHIPS' PIPING SYSTEMS	BIW/F 25.13		JAN. 30, 1979 & SEPT. 20, 1979					TECH. SUBCOM. F-25.13 SURVEYED RE: PROCEEDING W/THIS TASK. UNANIMOUS AGREEMENT REACHED TO CONTINUE.
GUIDELINES FOR SHIPBOARD AUTOMATION INTERFACE CONTROL	BIW/F-25.06		MARCH 8, 1979 & OCT. 3, 1979					DELETED FROM TASK S-23 AS A CONSTRUCTION STD. & DEVELOPED AS A STD. ENGINEERING GUIDELINE INSTEAD.
CONSTRUCTION STANDARDS, GROUP II	TASK S-24							
SELECTING BOLTING LENGTHS FOR PIPING SYSTEM FLANGED JOINTS	NASSCO/F-25.13	SEPT. 1, 1978	OCT. 2, 1978	JUNE 7, 1979	MAY 15, 1980			
FUNNELS	NASSCO/F-25.13	SEPT. 1, 1978	APRIL 25, 1979	SEPT. 27, 1979	MAY 15, 1980			
INSULATED WATERTIGHT BULKHEAD & DECK PENETRATIONS FOR NON-FERROUS PIPING PASSING THROUGH STEEL STRUCTURE	NASSCO/F-25.13	SEPT. 1, 1978	APRIL 25, 1979	SEPT. 24, 1979, MAY 15, 1980 & AUG. 13, 1979				
STEEL FLANGES FOR NON-FERROUS PIPING	NASSCO/F-25.13	SEPT. 1, 1978	APRIL 25, 1979	AUG. 13, 1979 & MAY 15, 1980				
PIPING SYSTEM DIAGRAM PREPARATION, TABLES, GENERAL NOTES, ETC.	NASSCO/F-25.13	SEPT. 1, 1978	MAY 18, 1979	OCT. 22, 1979				
WELDED SLEEVE FOR W.T. & O.T. BHD. & DK. PENETRATIONS FOR FERROUS & NON-FERROUS PIPE & TUBING	NASSCO/F-25.13	SEPT. 1, 1978	JUNE 19, 1979	AUG. 29, 1979 & MAY 15, 1980				
COMMERCIAL STEEL AIR RECEIVERS	NASSCO/F-25.13	SEPT. 1, 1978	JAN. 11, 1980					
COMMERCIAL STEEL POTABLE WATER TANK	NASSCO/F-25.13	SEPT. 1, 1978	APRIL 8, 1980					

ATTACHMENT (1)

NATIONAL SHIPBUILDING STANDARDS PROGRAMS

DATE: SEPT. 1980

STATUS OF SNAME/MARAD SPONSORED SHIPBUILDING STANDARDS PROGRAMS

PROGRAM	SPONSOR	STATUS: TECHNICAL DEVELOPMENT	DRAFT	F25 SUB-BALLOT	F25 BALLOT	ASTM BALLOT	FINAL PUBLICATION	REMARKS
NAVAL DESIGN/CONSTRUCTION STANDARDS	TASK S-25							
Goosenecks	BIW/F-25.05	APRIL 17, 1980	JUNE, 1980					
Terminals	BIW/F-25.05	APRIL 24, 1980	JUNE, 1980					Data sent for participant review April, 1980.
Fire Dampers	BIW/F-25.05	APRIL 30, 1980						Data sent for participant review May, 1980.
Control Dampers	BIW/F-25.05	MAY, 1980						
Duct Hangers	BIW/F-25.05	JULY, 1980						
Duct Details	BIW/F-25.05							
WT/NWT Closures	BIW/F-25.05							
Penetrations	BIW/F-25.05							
Drafting Std.	BIW/F-25.05	MAY, 1980						
Volumetric Test Std.	BIW/F-25.05	MARCH, 1980	JUNE, 1980					Data sent for participant review April, 1980. Contract signed Nov. 9, 1979.
OUTFIT CONSTRUCTION STANDARDS	TASK S-27							
Inclined Ladders	SUN/F-25.03	JULY 1980						
Bilge Keel Details	SUN/F-25.03							
Manholes	SUN/F-25.03	JULY 1980						
Rails (Open, Storm, Guard)	SUN/F-25.03							
Mach'y Space Floor Plates and Handrails	SUN/F-25.03	JULY 1980						
Vertical Ladders & Grabs	SUN/F-25.03							
STANDARD PIPING MATERIAL SCHEDULE	TASK S-28 BIW/F-25.13	FEB., 1980	AUGUST 1980					
CONSTRUCTION TOLERANCE STANDARDS	TASK S-21A SUN/F-25.04	APRIL, 1980	JUNE, 1980					Authorized to expend funds allocated to Task S-23.
NAVY WELD DEFECT TOLERANCE STUDY	TASK S-26 SUN/F-25.12	FEB., 1980						Authorized to expend funds allocated to Task S-21.
STANDARDS PROGRAM LONG RANGE PLAN	TASK S-29 BIW/F-25.91							

PROGRAM	SPONSOR	STATUS: TECHNICAL DEVELOPMENT	DRAFT REVIEW	F25 SUB BALLOT	F25 BALLOT	ASTM BALLOT	FINAL PUBLICATION	REMARKS
MECHANICAL DESIGN/CONSTRUCTION STANDARDS - GROUP III	TASK S 40							
Valve Label Plates	NASSCO/F-25.1[illegible]							
Thermometer Connections	NASSCO/F 25.1[illegible]							
Ovbd. Disch. Conn. Designs	NASSCO/F-25.1[illegible]							
Lifting Padeye Designs	NASSCO/F-25.1[illegible]							
Bilge Strainer Boxes	NASSCO/F-25.1[illegible]							
Orifice Plates	NASSCO/F-25.1[illegible]							
Selection & Arrangement of Valve Operating Gear	NASSCO/F-25.1[illegible]							
STANDARD PIPING DIAGRAMS	TASK S-32							
F.O. Service System								
F.O. Transfer System								
QA/QC ACCEPTANCE STANDARDS	TASK S-33 NN/F-25.07							
DEVELOPMENT OF: Repair Standards	TASK S-33A							
Inspection Standards	NN/F-25.07							
Accuracy Cont. Stds.								
Tolerance Standards								
Process Standards								

DATE: SEPT., 1980

NATIONAL SHIPBUILDING STANDARDS PROGRAM

STATUS OF ASTM COMMITTEE F-25 VOLUNTARY STANDARDS DEVELOPMENT

STANDARD TITLE	SUB-COMMITTEE	STATUS						REMARKS
		TECHNICAL DEVELOPMENT	DRAFT	F25 SUB-BALLOT	F25 BALLOT	ASTM BALLOT	FINAL PUBLICATION	
VERTICAL LADDERS	F 25.03	NOV. 16, 1978	APRIL 20, 1979	OCT. 22, 1979				
JOINER DOORS & FRAMES	F 25.03	NOV. 10, 1978	APRIL 10, 1979					
BERTHS	F 25.03	NOV. 16, 1978	JAN. 25, 1979					
DIESEL INSTRUMENTATION/CONTROLS	F-25.06	APRIL 18, 1979						DRAFT NEARLY COMPLETE.
DISPENSING TANK (5 & 10 GAL.)	F-25.07	OCT. 26, 1978	MARCH 26, 1979	APRIL 20, 1979	FEB. 4, 1980	MAY 29, 1980	JULY 3, 1980	*B/S PART 46, 1981 (SUB. .07)
MOORING WINCHES	F-25.08	MAY 23, 1979	SEPT. 9, 1979					
ANCHOR WINDLASSES	F-25.08	MAY 23, 1979	SEPT. 9, 1979					
ELEVATORS	F-25.08	MAY 23, 1979	SEPT. 9, 1979					
MAIN TURBINE SPECIFICATIONS	F-25.11	MAY 22, 1979						
AUX. TURBINE SPECIFICATIONS	F-25.11	MAY 22, 1979						
CENTRIFUGAL PUMPS	F-25.11	MAY 22, 1979						
H.P. BOLTED BONNET VALVES	F-25.13	JAN. 1979	MAY 1979					DRAFT COMPLETED UNDER NAVSEA SPONSORSHIP & SUBMITTED FOR ASTM F-25 PROCESSING IN LIEU OF DEVELOPING NEW MIL-SPEC
FIBERGLASS PIPE	F-25.13	JAN. 1979	JUNE 1979					
PAINT STANDARD PRODUCT DATA SHEET	F-25.02	JAN. 1979	MAY 1979	JULY 1980				SAME AS ABOVE.

*FIRST F-25 COMMITTEE ON SHIPBUILDING STANDARDS TO BE PUBLISHED.

ATTACHMENT (2)

S N A M E

S H I P P R O D U C T I O N

C O M M I T T E E

PANEL SP-1 - FACILITIES

PANEL SP-2 - PRODUCTION TECHNIQUES

PANEL SP-6 - STANDARDS & SPECIFICATIONS

PANEL SP-7 - WELDING

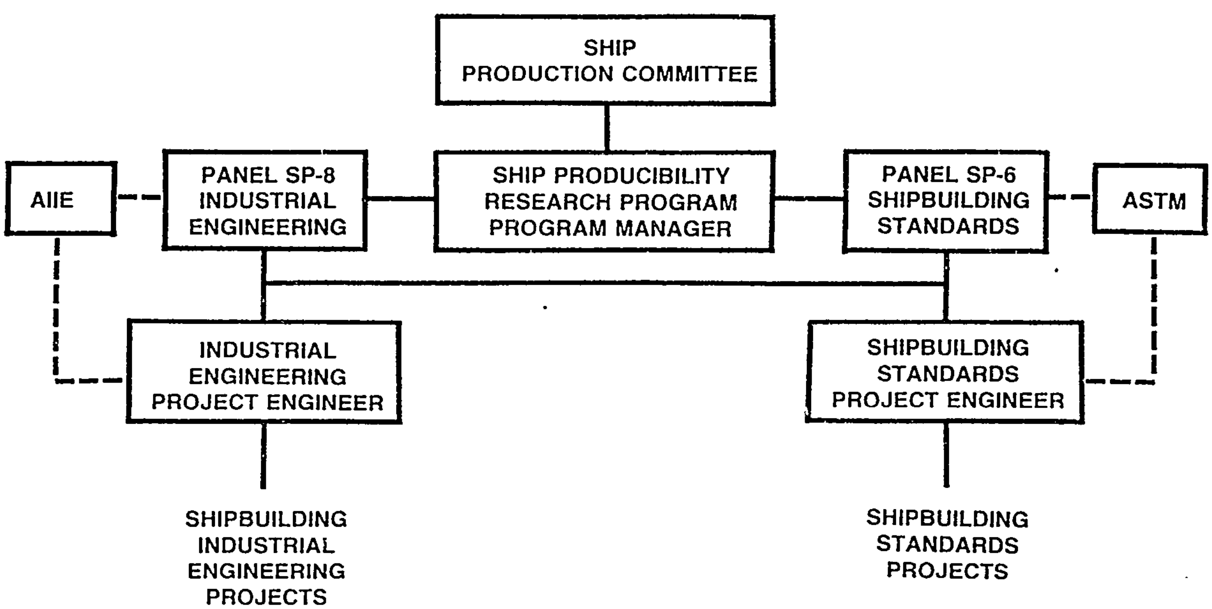
PANEL SP-8 - INDUSTRIAL ENGINEERING

PANEL 0-23-1 - SURFACE PREP. & COATINGS

REAPS GROUP - SHIPYARD AUTOMATION

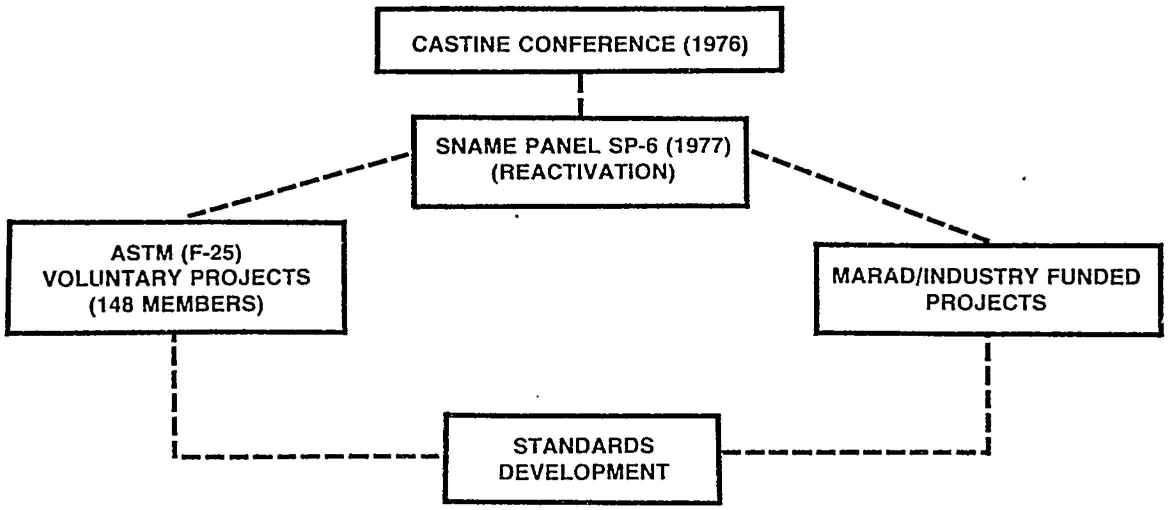
S H I P P R O D U C I B I L I T Y

R E S E A R C H P R O G R A M



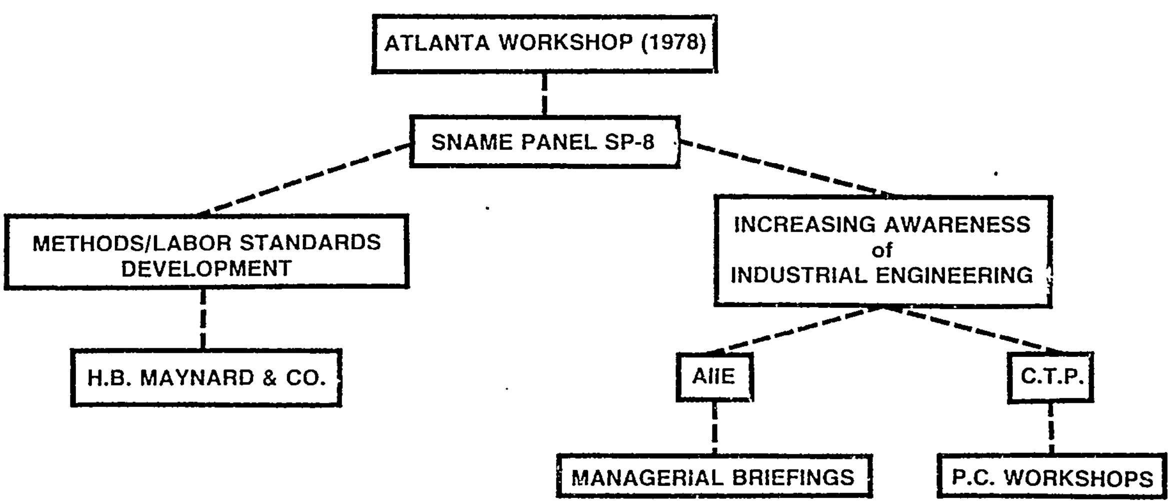
SHIP PRODUCIBILITY RESEARCH PROGRAM

STANDARDS & SPECIFICATIONS PANEL SP-6

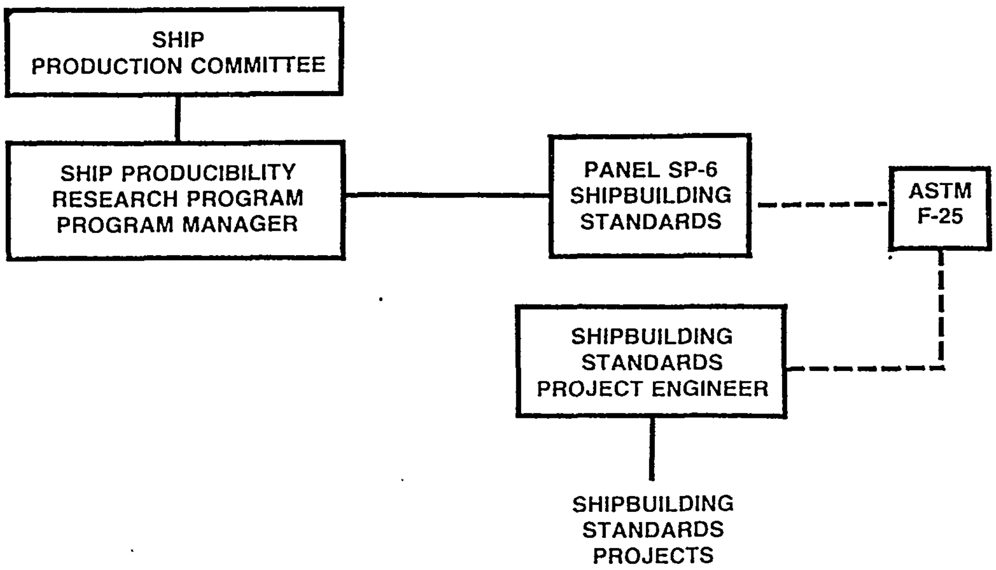


SHIP PRODUCIBILITY RESEARCH PROGRAM

INDUSTRIAL ENGINEERING PANEL SP-8



SHIP PRODUCIBILITY RESEARCH PROGRAM



SNAME PANEL SP-6 STANDARDS AND SPECIFICATIONS

SCOPE: *To act as the U.S. Shipbuilding Industry's steering committee for the National Shipbuilding Standards Program and to set shipyard plans and priorities for standard development, and thru the SNAME Ship Production Committee, recommend cooperative* MARAD/Industry cost-shared *projects which will* accelerate *direct benefits to the industry.*

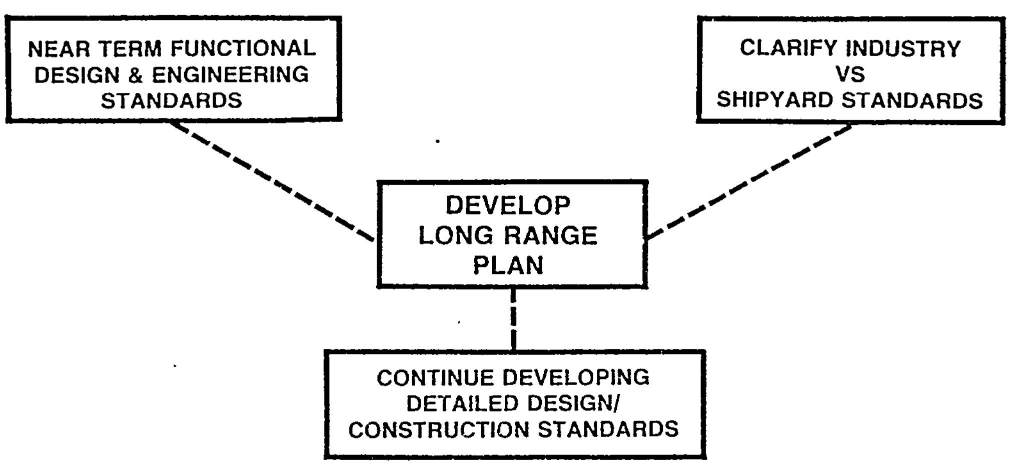
PANEL SP-6 MEMBERSHIP

AVONDALE SHIPYARDS
BATH IRON WORKS
BETHLEHEM STEEL
DAVIE SHIPBUILDING. LTD.
LEVINGSTON SHIPBUILDING
MARITIME ADMINISTRATION
NAVSEA
NASSCO
NEWPORT NEWS
SUNSHIP INC.
WILEY MFG.

PROSPECTIVE MEMBERS

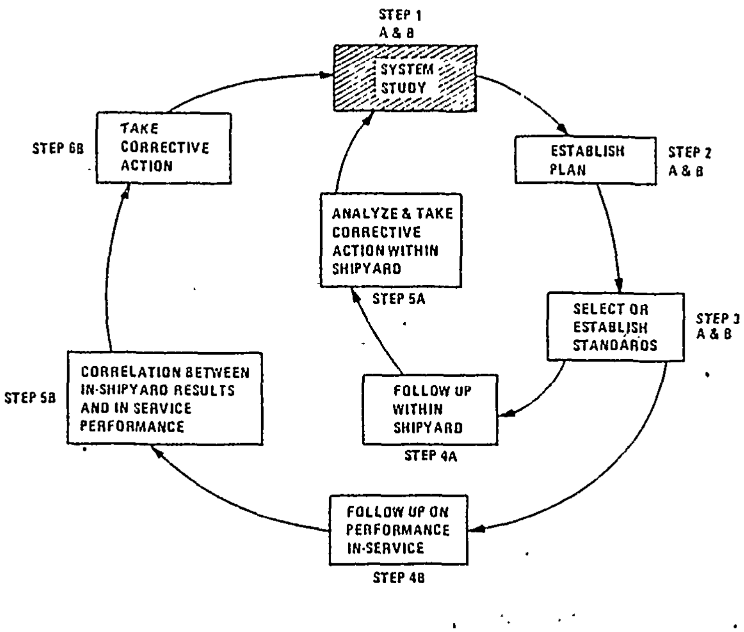
BAY SHIPBUILDING
MARINETTE MARINE
PETERSON BUILDERS
GD/QUINCY SHIPBUILDING DIV.
TACOMA BOAT BUILDING

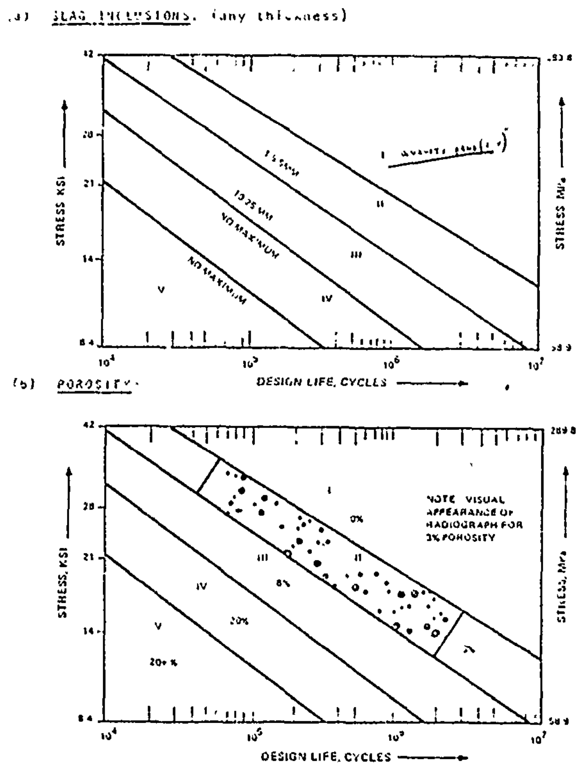
CURRENT SP-6 PRIORITIES



WELD DEFECT TOLERANCE STUDY

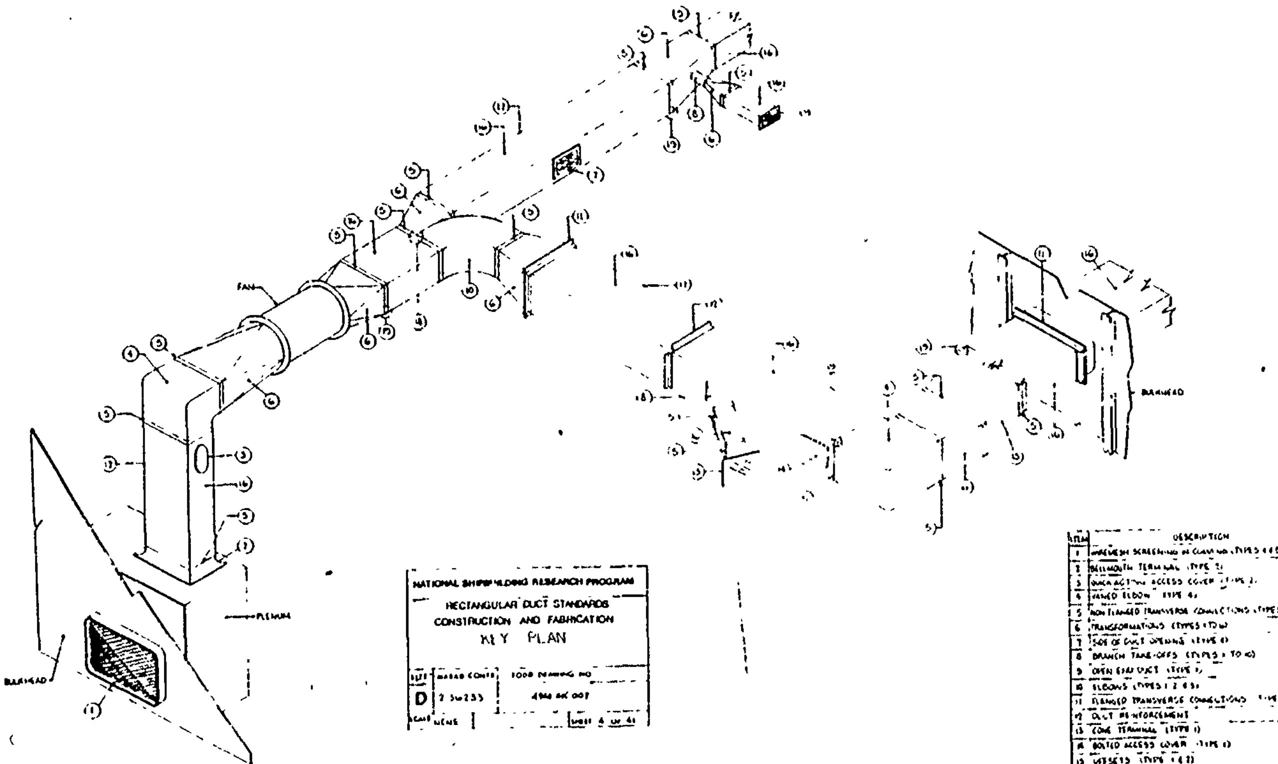
TASK S-22





SUN SHIPBUILDING INC.

HVAC DESIGN/CONSTRUCTION STANDARDS
TASK S-25



ITEM	DESCRIPTION	SHEET NO
1	WIRE MESH SCREENING AT COAMING (TYPES 1 & 5)	34 35 36 38
2	BELLMOUTH TERMINAL (TYPE 2)	19 33 35 37
3	QUICK ACTING ACCESS COVER (TYPE 2)	31
4	VANED ELBOW (TYPE 4)	[illegible]
5	NON FLANGED TRANSVERSE CONNECTIONS (TYPES 8 TO 11)	[illegible]
6	TRANSFORMATIONS (TYPES 1 TO 6)	[illegible]
7	SIDE OF DUCT OPENING (TYPE 1)	34 35 37
8	BRANCH TAKE-OFFS (TYPES 1 TO 10)	17
9	OPEN END DUCT (TYPE 1)	33 35 37
10	ELBOWS (TYPES 1 2 & 3)	[illegible]
11	FLANGED TRANSVERSE CONNECTIONS (TYPES 1 TO 7)	[illegible]
12	DUCT REINFORCEMENT	39
13	CONE TERMINAL (TYPE 1)	[illegible]
14	BOLTED ACCESS COVER (TYPE 1)	30
15	OFFSETS (TYPES 1 & 2)	6 9
16	STRAIGHT DUCT	5
17	LONGITUDINAL SEAMS (TYPES 1 TO [illegible])	22
18	PREPARATION OF DUCT AT SPLITS	40
19	END OF DUCT PREPARATION	41

BATH IRON WORKS CORP.

STANDARD PIPING MATERIAL SCHEDULE
TASK S-28

U.S. DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION
WASHINGTON, D.C. 20235

MARITIME ADMINISTRATION
SCHEDULE FOR PIPES, JOINTS, VALVES
FITTINGS AND SYMBOLS

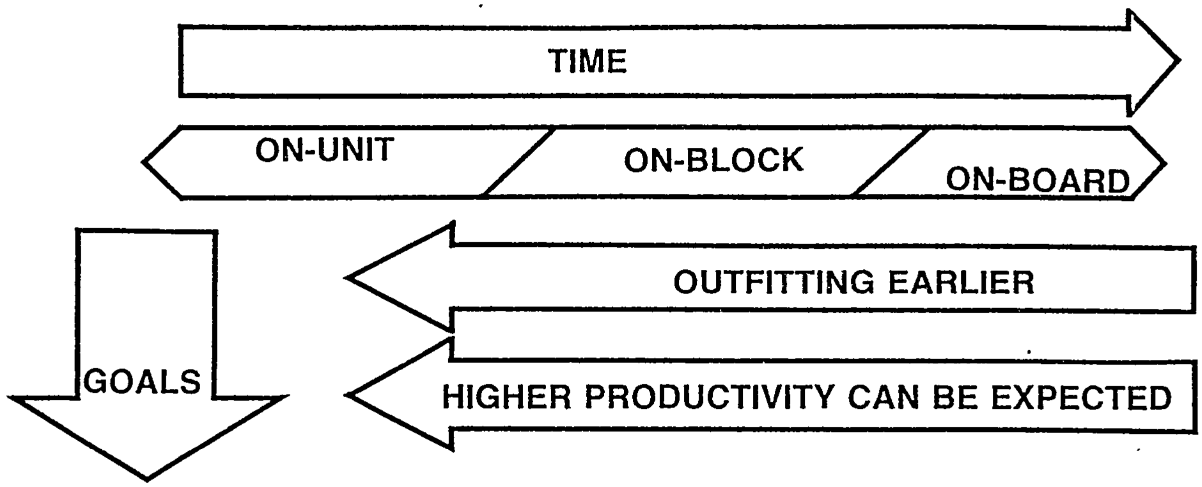
M.A. PLAN NO. S48-26-2, ALT. 3

NOVEMBER 1, 1957
Revised February 1, 1969

FOR OFFICIAL DISTRIBUTION

BATH IRON WORKS CORP.

ZONE OUTFITTING SUMMARY

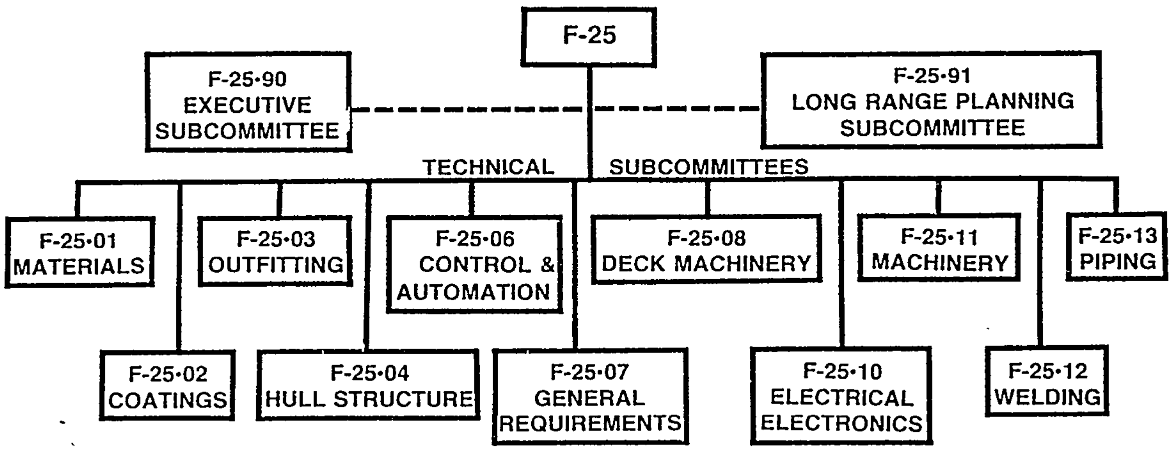


1) TO MINIMIZE WORK ON-BOARD (LOW EFFICIENCY WORK) AND TO INCREASE WORK IN SHOPS (HIGH EFFICIENCY WORK).
2) TO COMPLETE WORK ZONE-BY-ZONE IN ORDER TO SIMPLIFY MANAGEMENT CONTROL.
3) TO AVOID INTERFACE PROBLEMS WITH HULL CONSTRUCTION AND PAINTING AND THEIR ASSOCIATED WORK PROCESSES.
4) TO IMPROVE EFFICIENCY OF FACILITIES, SHOP, WAYS/DOCK, AND OUTFITTING PIERS BY EARLIER OUTFITTING AND MORE UNIFORM APPLICATION OF OUTFIT MANPOWER.

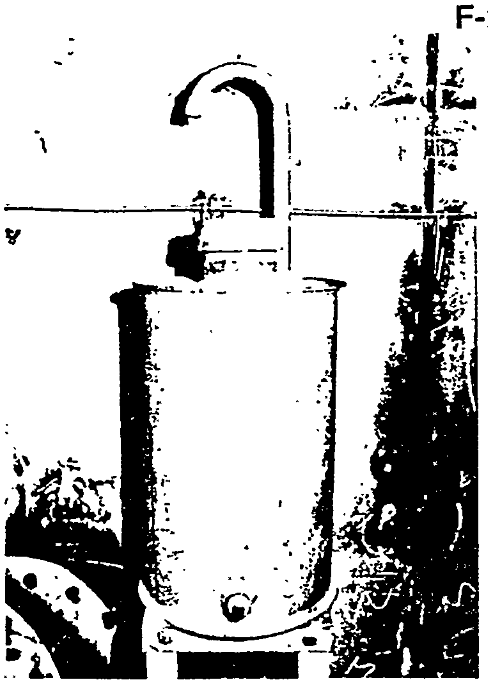
ASTM COMMITTEE F-25
SHIPBUILDING STANDARDS

SCOPE: *The scope of the Committee shall be to develop standard specifications, test methods, definitions, and practices for design construction, and repair of marıne vessels. The committee will coordınate its efforts with other ASTM committees and outsıde organizatıons having mutual interest.*

COMMITTEE F-25 ORGANIZATION



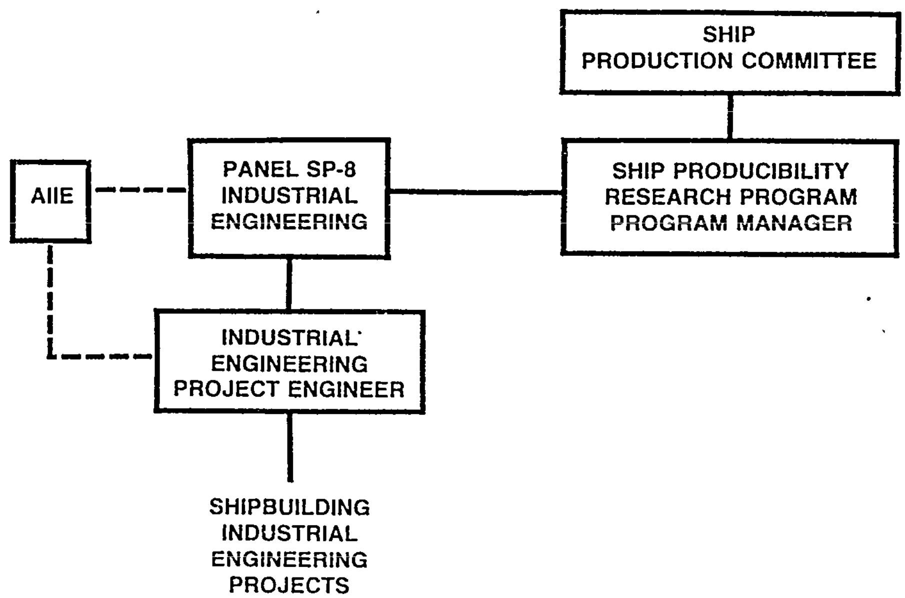
5 & 10 GAL. DISPENSING TANK
F-25•07



BEFORE

AFTER

SHIP PRODUCIBILITY RESEARCH PROGRAM



SNAME PANEL SP-8 INDUSTRIAL ENGINEERING

SCOPE: *To assist U.S. shipyards in the development and implementation of an improved industrial engineering capability.*

SP-8 PRIORITY ACTION ITEMS

(A) METHODS ENGINEERING/LABOR STANDARDS DEVELOPMENT

(B) INCREASE SHIPBUILDING MANAGEMENT AWARENESS OF THE SCOPE AND POTENTIAL OF BASIC INDUSTRIAL ENGINEERING TECHNIQUES IN SHIPBUILDING

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